A Revision of the Orders Eoacanthocephala and Palaeacanthocephala (Acanthocephala) Parasitic in Fishes, Birds and Marine Mammals.

ABSTRACT OF

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The present thesis comprising seven chapters and twenty plates of diagrams pertains to a concise revision of the Orders Eoacanthocephala VAN CLEAVE, 1936 and Palaeacanthocephala MEYER, 1931 and also includes descriptions of some new species, genera and families.

Chapters I, II and III include the Introduction (and Acknowledgements), Historical Review and Material and Methods respectively. Chapter IV comprises the main taxonomic portion of the thesis and contains descriptions of new taxa proposed in the present study and redescriptions of certain species which were inadequately described originally and whose type material could be made available to the present author for re-examination.

Chapter V contains a gross revision of the generic and supra-generic categories of these two Orders and their systematic evaluation is presented family-wise. The System of MEYER (1931), as modified by VAN CLEAVE (1936, 1948) is adopted as the principal taxonomic base of the present study and a critical evaluation of the previous schemes (SOUTHWELL & MACFIE, 1925; TRAVASSOS, 1926; THAPAR, 1927 MEYER, 1931, 1932; WITENBERG, 1932; PETROCHENKO, 1956; GOLVAN, 1959, 1960, 1969; YAMAGUTI, 1963) is presented in detail. In this context and in the light of the discussions in the foregoing chapters of this thesis, a revised scheme of classification of these two Orders — Eoacanthocephala and Palaeacanthocephala — is presented in Chapter VI (pp. 278-284). A revised key to the generic and supra-generic categories of these two Orders is also appended in the same chapter (pp. 285-311). A concise bibilography comprising 357 references cited in the text is given in Chapter VII. Only 23 of these references could not be consulted in original. Such titles are marked with an asterisk. The Plates (I-XX) contain 159 figures and pertain to the species described and/or redescribed in Chapter IV.

The following taxonomic descriptions, decisions and amendments are presented in the Thesis :

(I) New Families :   (A) Order Palaeacanthocephala:

(1) Acanthodeltidae n. fam. - Type genus : *Acanthodelta* DIAZ-UNGRIA & GRACIA-RODRIGO, 1958

(2) Mirzasentidae n. fam. - Type genus : *Mirzasentis* n. gen.

(II) New Genera :   (A) Order Palaeacanthocephala:

(1) *Parafilisoma* n.gen., (2) *Mirzasentis* n.gen., (3) *Porrorchoides* n.gen

(III) New Species :   (A) Order Eoacanthocephala.

(1) *Acanthogyrus thapari* n. sp.   (2) *Acanthosentis pauciuncinatu*

(3) *Pallisentis fragilis* n. sp.   (4) *Pallisentis major* n. sp.

(5) *Neoechinorhynchus acanthuri* n. sp.   (6) *N. mollissimus* n. sp.

(7) *N. paratylosuri* n. sp.   (8) *N. nigeriensis* n. sp.

(9) *N. minutus* n. sp.

(10) *Floridosentis longinuchalis* n. sp.

(B) Order Palaeacanthocephala:

(11) *Hipporhynchus atheri* n.sp., (12) *Micracanthorhynchina indica* n.sp

(13) *Mehrarhynchus alami* n. sp., (14) *Acanthocephaloides venustus* n.sp

(15) *Mirzasentis torquis* n. sp., (16) *Longicollum pulcher* n.sp.,

(17) *Parafilisoma diazungriai* n. sp.,

(18) *Plagiorhynchus salubris* n.sp., (19) *Lueheia mitis* n.sp.,

(20) *Porrorchoides texeris* gen. et sp. novo.,

(21) *Centrorhynchus lepidus* n.sp., (22) *Centrorhynchus alunis* n.sp.,

(23) *Centrorhynchus venezuelensis* n.sp., (24) *C. pseudibicola* n.sp.

(25) *Centrorhynchus ophionis* n. sp.

IV. <u>The following new combinations are proposed</u> :

(1) *Pallisentis nesteri* (TADROS,1966) n.comb.,

(2) *Neosentis partispinus* (FURTADO,1963)n.comb.,

(3) *Acanthocephalorhynchoides cholodkowski* (KOSTYLEW,1928) n.comb.,

(4) *Arhythmacanthus plotosi* (YAMAGUTI,1935) n.comb.,

(5) *Furtadosentis ophiocephali* (FURTADO & CHAU-LAN,1971) n. comb.

(6) *Nipporhynchus polynemi* (TRIPATHI,1959) n. comb.,

(7) *Neoacanthocephaloides distinctus*(GOLVAN,1969) n. comb.,

(8) *Neoacanthocephaloides golvani* nom. nov., for *Acanthocephaloides propinquus* of GOLVAN,1969 nec MEYER,1932.

(9) *Mehrarhynchus indicus* (TRIPATHI,1959),n. comb.,

(10) *Paracavisoma gomesi* (MACHADO FILHO,1948),n.comb.,

(11) *Paracavisoma salobrensis* (MACHADO FILHO,1948),n. comb.,

(12) *Paracavisoma briconi* (MACHADO FILHO,1948) n. comb.,

(13) *Paracavisoma jucundum* (MACHADO FILHO,1948) n. comb.,

(14) *Pseudocavisoma hemiculturum* (DEMSHIN,1965) n. comb.,

(15) *Diplospinifer hispidus* (VAN CLEAVE,1925) n. comb.,

(16) *Diplospinifer duocinctus* (CHANDLER,1935) n. comb.,

(17) *Diplospinifer ardeae* (BELOPOLSKAIA,1958) n. comb.,

(18) *Diplospinifer ponticae* (PETROCHENKO & SMOGORZHEVSKAIA,1962) n.com

V. <u>New synonyms</u> :

<u>(a) Families</u> :

(1) Dendronucleatidae SOKOLOVSKAIA,1967 and Hebesomatidae VAN CLEAVE, 1928 emnd. YAMAGUTI,1963 are considered synonyms of Neoechinorhynchidae.

(2) Pseudacanthocephalidae PETROCHENKO,1956 is regarded as a direct synonym of Echinorhynchidae COBBOLD,1879.

(b) *Genera* :

(1) *Saccosentis* TADROS, 1966 = *Pallisentis* VAN CLEAVE, 1928.

(2) *Devendrosentis* SAHAY et al, 1971 = *Pallisentis* VAN CLEAVE, 1928

(3) *Dendronucleata* SOKOLOVSKAIA, 1967 = *Neoechinorhynchus* HAMANN, 1905

(4) *Raorhynchus* TRIPATHI, 1959 = *Hipporhynchus* CHANDLER, 1934

(5) *Indorhynchus* GOLVAN, 1969 = *Mehrarhynchus* DATTA, 1940

(6) *Dentàtruncus* SINZAR, 1955 = *Pseudorhadinorhynchus* ACHEROW & DOMBROVSKAIA-ACHMEROVA, 1941

(7) *Cleaveius* SUBRAHMANIAN, 1927 = *Pallisentis* VAN CLEAVE, 1928

(8) *Paracanthocephaloides* GOLVAN, 1969 = *Acanthocephaloides* MEYER, 1931

(9) *Acanthocephaloides* sensu GOLVAN, 1969 nec MEYER, 1932 = *Neoacanthocephaloides* CABLE & QUICK, 1954.

(10) *Hemiechinosoma* PETRORCHENKO & SMOGORZHEVSKAIA, 1962 = *Diplospifer* FUKUI, 1929.

(11) *Pseudacanthocephalus* PETROCHENKO, 1956 = *Acanthocephalus* KOELREUTHER, 1771.

(12) Subgenus *Subcorynosoma* KHOKHLOVA, 1967 = *Polymorphus* LÜHE, 1911

(13) Subgenus *Subfilicollis* KHOKHLOVA, 1967 = Polymorphus LÜHE, 1911

(14) *Pseudoechinorhynchus* PETROCHENKO, 1956 nec GOEZE, 1782 = *Echinorhynchus* MULLER, 1776.

(c) *Species*:

(1) *Acanthogyrus tripathii* RAI, 1967= *Acanthogyrus acanthogyrus* THAPAR,

(2) *Acanthosentis betwai* TRIPATHI, 1959 and

(3) *A. hilsai* PAL, 1967 = *Acanthosentis antspinus* VERMA & DATTA, 1929.

(4) *Pallisentis colisai* SARKAR, 1956 = *Pallisentis nandai* SARKAR, 1953

(5) *Pallisentis buckleyi* TADROS, 1966= *Pallisentis basiri* FAROOQI, 1958

(6) *Devendrosentis garuai* SAHAY et al, 1971 = *Pallisentis nagpurensis* BHALERAO, 1931)

(7) *Rhadinorhynchus polynemi* GUPTA & LATA, 1967 = *Hipporhynchus polyne* (TRIPATHI, 1959).

(8) *Filisoma hoogliensis* DATTA & SOOTA,1962 and

(9) *F. scatophagusi* DATTA & SOOTA,1962 = *F. indicum* VAN CLEAVE,1928.

(10) *Micracanthorhynchina dakusuensis* HARADA,1938 = *Micracantho-rhynchina motomurai* (HARADA,1935).

(11) *Pomphorhynchus dubius* KAW, 1947 = *P. kashmiriensis* KAW,1947

(12) *Serrasentis chauhani* DATTA,1954 and

(13) *Serrasentis longa* TRIPATHI,1959 = *S. socialis* (LEIDY,1851)

(14) *Pseudoporrorchis indicus* DAS,1947 = *Porrorchis centropi* (PORTA)

(15) *Pseudoporrorchis houdemeri* JOYEUX & BAER,1935 = *Porrorchis - centropi* (PORTA,1910).

(16) *Centrorhynchus bengalensis* DATTA & SOOTA,1955 = *C. knowlesi* DATTA & SOOTA, 1955

(17) *Centrorhynchus corvi* FUKUI, 1929 , *Centrorhynchus turdi* YAMA-GUTI,1939. *C. splendi* GUPTA & GUPTA,1970 = *C. robustus* (DATTA, 1928) comb. nov.

(18) *C. brevicanthus* DAS,1950 = *C. pinguis* VAN CLEAVE,1916.

VI. The following species are redescribed :

(1) *Pallisentis umbellatus* VAN CLEAVE,1928

(2) *Quadrigyrus torquatus* VAN CLEAVE,1920

(3) *Tanaorhamphus ambiguus* VAN CLEAVE,1921.

VII. The genus *Furtadosentis* is proposed for *Gorgorhynchus ophio-cephali* FURTADO & CHAU-LAN,1970 since the latter does not conform with its original generic epithet.

VIII. Serrasentinae PETROCHENKO,1956 and Polyacanthorhynchinae PETROCHENKO,1956 are upgraded as families.

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January 4, 1973

This is to certify that Mr. Hisamuddin Farooqi has completed his research under my supervision for the degree of Doctor of Philosophy of the Aligarh Muslim University, Aligarh. This amounts to an original contribution and a distinct addition to the existing knowledge of the subject.

He is allowed to submit the work for Ph.D degree of the Aligarh Muslim University, Aligarh.

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I. INTRODUCTION

During the past two decades the Acanthocephala have attracted considerable attention of helminthologists all over the world. Much has been contributed in this field during this period than ever before. The number of known species and their corresponding higher taxa has increased by almost three-times than what it was in the early thirties of the present century when ANTON MEYER (1932) had published the first-ever comprehensive treatise on Acanthocephala in BRONNS KLASSEN und ORDNUNGEN des TIERREICHS series.

Relatively more has been subscribed to the systematics of these parasites than to other aspects of their biology. Numerous contributions have been made by investigators from different parts of the world and these have considerably enriched the faunistic knowledge about these worms from different host groups.

Besides numerous restricted contributions quite a few comprehensive and, occassionally, monographic studies have been published by various workers, notable among them being those of RAUTHER (1930), MEYER (1931, 1932, 1938), WITENBERG (1932), WULKER & SCHUURMAANS-STEKHOVEN, Jr (1933), von HAFFNER (1950) and SPREHN (1958) from Germany, LUNDSTROM (1942) from Sweden, PETROCHENKO (1956, 1958) from the Soviet Union, GOLVAN (1959, 1960, 1962, 1964, 1969) and BAER (1961) from France and her erstwhile colonial territories, YAMAGUTI (1935, 1939, 1963) from Japan, VAN CLEAVE (1948, 1953) from North America and TRAVASSOS (1926) from South America.

Through these contributions not only that many new forms have been brought to fore but sometimes notable changes, occassionally arousing controversies, have been induced into the systematics of the group. Consequently, it becomes appropriate, and timely, that a re-evaluation of acanthocephalan taxonomy should b[illegible] attempted in the above perspective as an effort to render it th[illegible] required perfection and to make it as up-to-date as possible[illegible]

During the last several years the present author h[illegible] [illegible]terested in the taxonomy of the Acanthocephala and has c[illegible] [illegible]er a period of years a large number of species from var[illegible] [illegible]oups of vertebrates. The present thesis is based on this [illegible] [illegible] Acanthocephala belonging mainly to the Orders Eoacanthoc[illegible] and Palaeacanthocephala. The author has endeavoured to describ[illegible] new forms present in his collection, redescribe inadequately known species and present a re-evaluation of the two main orders, Eoacanthocephala and Palaeacanthocephala.

It is obvious that a detailed revision of the group Acanthocephala can not be undertaken at the out-set and is beyond the scope of the present thesis. However, the author has tried to present an appraisal of the various schemes of classification proposed by previous workers and, in the light of these, a revised scheme of classification is being proposed with appropriate comments where necessary.

The diagrams are also restricted to those forms which are either being described as new species or were originally inadequately figured by previous workers and are being redescribed in the present study. Keys and discussions are also presented.

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Many other individuals, from India and abroad, have given generous co-operation by extending collections or lending type specimens from their Institutions. For this, the writer is grateful to Dr. Carlos Diaz-Ungria, Caracas, Venezuela; Dr. W.L. Bullock, Durham, N.H.; Dr. D. Machado Filho, Rio de Janeiro; Dr. B. Bezubik, Warsaw, Poland and to Dr. S. Kamegai, Director, Meguro Parasitological Museum, Tokyo for sending rich acanthocephalan collections from Venezuela, North America, Brazil, Poland and Japan, respectively. Dr. Allen McIntosh kindly lent out Van Cleave's Types from the US National Museum Helminthological Collections, Beltsville, Md., and Dr. G. Hartwich enabled the writer to borrow Meyer's and Rudolphi's Types from Berlin Museum. Dr. O.W. Olson, Colorado, USA, and Drs. Ilmaro Valovirta and Pekka Nuorteva from Helsinki presented speciemns of various species of <u>Corynosoma</u> from North American and European hosts. Herr Roy Olerod kindly lent some paratypes from the Naturhistoriska Museet, Stockholm and Dr. Machado Filho provided Type specimens from Instituto Oswaldo Cruz, Rio de Janeiro. Professor G.F. Rees extended a collection of Acanthocephala from

Bermuda; Dr. R.Ph. Dollfus, Paris kindly lent the syntypes of Acanthogyrus nigeriensis DOLLFUS & GOLVAN, 1956 and Dr. T. Fukui, Tokyo, offered the Types of his species, *Porrorchis elongatus* FUKUI, 1929, *Centrorhynchus magnus* FUKUI, 1929, *C. corvi* FUKUI, 1929 and *C. itatsinus* FUKUI, 1929. To all these colleagues, the writer is grateful beyond measure.

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The writer is also thankful to the Director, Zoologica Survey of India, Calcutta, for kindly permitting him to study National Collection of Acanthocephala at the Indian Museum. It also a privilege to acknowledge the help of Dr. T.D. Soota, Superintending Zoologist, Zoological Survey of India, Calcutta in this connection.

Thanks are also due to Professor S.M.H. Khatib for kindly extending the Das collection of acanthocephala from Nagpur, and to Dr. Y.R. Tripathi, Allahabad for lending types of acanthocephalan species described by him from Indian fishes.

II. Historical Review

Spiny-headed worms, later named as Acanthocephala by RUDOLPHI (1808) were first noticed by REDI (1684) and subsequently reported by LEEUWENHOEK (1692) from the intestines of European eels. These parasites were later recognised as a distinct taxonomic organization when KOELREUTER (1771) and later MULLER (1776) independently proposed the two genera, *Acanthocephalus* and *Echinorhynchus* respectively. The creation of these two genera eventually paved the way for further investigations in this field and contemporary workers of the last quarter of the seventeenth century like PALLAS (1775), MULLER (1776, 1780), GOEZE (1782) and SCHRANK (1788) described about sixtyfive species of acanthocephalan parasites from Europe alone.

The group further attracted attention of many workers in this field in the nineteenth century and RUDOLPHI (1801, et seq) and some of his contemporaries like ZEDER (1803), BREMSER (1811), and later on, DIESING (1851) and LINSTOW (1876, et seq) described more than two hundred species, mostly assigned to the genus *Echinorhynchus* from various hosts. This increase in the number of the then known species and the diversity which they presented among themselves necessitated recognition of higher taxonomic categories. Consequently, COBBOLD (1876) erected the family Echinorhynchidae to accommodate the single genus *Echinorhynchus* but did not define its characters and LEUCKART (1886) proposed the other family, Acanthocephalidae, apparently to include the genera *Acanthocephalus* as well as *Echinorhynchus*.

HAMANN ((1892) was the first taxonomist to envisage a classification of the Acanthocephala which accordingly comprised three monotypic families, Neorhynchidae, Echinorhynchidae and Gigantorhynchidae on the basis of the three genera, Neorhynchus (later named as Neoechinorhynchus HAMANN, 1905), Echinorhynchus and Gigantorhynchus respectively ; the first and the last named of each having been proposed anew. The genus Acanthocephalus, however, remained in oblivion and was resurrected much later (LUHE, 1911).

Hamann's scheme and the concepts which he instituted became the basis of the future taxonomy which attained remarkable expansion during the earlier half of the present century through the pioneering contributions of MONTICELLI (1900, 1905, 1915), PORTA (1901, 1904, 1906, 1907, 1908, 1910, 1912, 1913, 1914), MARVAL (1902, 1904, 1905), LUHE (1905, et seq), KOSTYLEW (1912, et seq), SKRJABIN (1913, et seq) and DOLLFUS (1929, 1931) from Europe ; JOHNSTON (1912, et seq) and his associates from Australia; LINTON (1901, et seq), LEIDY (1904) and VAN CLEAVE (1913, etseq) from North America and of TRAVASSOS (1913, et seq) from Brazil, South America. These authors, and many others as well, described about thirty genera and a still greater number of constituent species during the first half of the present century, and, to impart a systematic treatment to them SOUTHWELL & MACFIE (1925) proposed a ' tentative' classification which comprised three sub-orders, viz, Neoechinorhynchidea, Echinorhynchidea and Gigantorhynchidea accommodating three, two and five families respectively. TRAVASSOS (1926) did not agree with this view and reverted the three sub-orders to to corresponding family groups.

In a later scheme THAPAR (1927) raised the sub-order Echinorhynchidea to an ordinal rank but eliminated the other two sub-orders, Neoechinorhynchidea and Gigantorhynchidea, and, instead proposed two more orders, the Apororhynchidea and Acanthogyridea. This system was not, however, accepted by later workers and was, therefore, relatively short-lived.

In 1931, MEYER proposed the most acceptable system of classification. He divided the class Acanthocephala into two orders, the Palaeacanthocephala and the Archiacanthocephala, each comprising six families. The two Orders were characterised with, and differentiated from each other on the basis of the form and nature of the proboscis receptacle, position of the longitudinal lacunar vessels, number and shape of the cement glands in males and the nature of ligament sacs and the pattern of egg-shells in females. However, a less redeeming aspect of this system was the inclusion of the family Acanthogyridae in the order Palaeacanthocephala and that of the family Neoechinorhynchidae in the order Archiacanthocephala although the only difference between the two families lies in the presence or absence of cuticular spines in the constituent genera of these two families which have closer affinities with each other rather than with the ordinal categories which they were originally assigned to.

It was perhaps this inconsistancy which prompted VAN CLEAVE (1936) to recognise the third Order, the Eoacanthocephala, to accommodate the families Neoechinorhynchidae, Acanthogyridae, Quadrigyridae, Pallisentidae and nebesomidae (sic) ; all these being incompatible with the basicc concepts of Palaeacanthocephala as well as Archiacanthocephala. This order (Eoacanthocephala) was characterised by having a single muscle-layered proboscis receptacle, dorsal and ventral position of the principal lacunar vessels and a single synoytial cement gland in males and persistent dorsal and ventral ligament sacs in females. The order was further divided into two sub-orders, Gyracanthocephala and Neoacanthocephala; the two being distinguished from each other on the basis of the presence (in the former) or absence (in the latter) of trunk spines. VAN CLEAVE (1936) thus formulated a system comprising three orders, Eoacanthocephala, Palaeacanthocephala and Archiacanthocephala, only the first of these having been sub-divided into two sub-orders.

In the meantime WITENBERG (1932) also proposed a system founded mainly on the lines of SOUTHWELL & MACFIE (1925) and THAPAR (1927). WITENBERG (loc. cit) maintained the three orders, Apororhynchidea, Echinorhynchidea and Acanthogyridea but deleted Neoechinorhynchidea and Gigantorhynchidea. The system, however, had certain discrepancies (discussed later in the present study) which precluded its recognition by subsequent workers.

VAN CLEAVE (1948) further elaborated his pre-existing system by according ACANTHOCEPHALA the status of a separate phylum and by erecting the two classes, Metacanthocephala, comprising the two orders, Palaeacanthocephala and Archiacanthocephala, and the class (originally an Order) Eoacanthocephala, also comprising two orders, Gyracanthocephala and Neoacanthocephala.

HYMAN (1951) reviewed the general organization of the group Acanthocephala which she accorded the status of a phylum but did not agree with Van Cleave's proposal of the two classes, Metacanthocephala and Eoacanthocephala, which she regarded (at least the former) as unwarranted; instead she did recognise the three categories, Eoacanthocephala, Palaeacanthocephala and Archiacanthocephala as valid ordinal groups.

HELEN WARD (1950, 1951) published a compendium of acanthocephalan taxa described since 1933, i.e. after the publication of Meyer's treatise but this was mainly a compilation of the taxa and did not furnish any systematic evaluation of the group. Ward followed the VAN CLEAVE system of classification but also retained the order Sphenacanthocephala BYRD & DENTON, 1949 although it had already been synonimised with the order Archiacanthocephala by VAN CLEAVE (1950).

The Russian School came into prominense mainly through the contributions of PETROCHENKO (1949, et seq), who published two serial monographs in 1956 and 1958 respectively. He also proposed a system of classification (PETROCHENKO, 1956: 139) which was essentially based on Hamann's concepts of the three families which he (PETROCHENKO, 1956) upgraded as sub-classes, naming them as Neoechinorhynchinea, Echinorhynchinea and Gigantorhynchinea; these three further comprising six orders, Neoechinorhynchida, Acanthogyrida, Echinorhynchida, Gigantorhynchida and Oligacanthorhynchida. Among other notable contributions from the Soviet Union are those of ACMEROV & DOMBROVSKAJA-ACHMEROVA (1941), ACHMEROV (1959), BELOPOLSKAJA (1952), KURASHVILI (1954, 1955, 1957) and BYCHOWSKI (1967).

The French School led by DOLLFUS (1929, et seq) has also made significant contribution and GOLVAN (1956, 1959, 1960, 1962, 1964, 1969) has prolifically contributed to the systematics of the Acanthocephala during the recent years. He has revived the concept of superfamilies in the heirarchy of of Acanthocephala and has until recently (GOLVAN, 1969) published an extensive review of the super-family Echinorhynchynchoidea which he has, perhaps ostensibly, accredited to GOLVAN & HOUIN, (1963) though such a category was proposed earlier by RAUTHER (1930).

YAMAGUTI (1935, et seq) has made some very notable contributions to the taxonomy of Acanthocephala from Japan and Far East. In a recent comprehensive treatise (YAMAGUTI, 1963) he has suggested a system based partly on Southwell & MacFie's and partly on Thapar's plans. YAMAGUTI (1963) has retained the same four ordinal groups which SOUTHWELL & MACFIE (1925) and lately, PETROCHENKO (1956) have adopted. However, not all of Yamaguti's proposals are acceptable to most of the recent workers in this field, and, as discussed later in the present study, some are subject to considerable emendment.

Besides the above mentioned studies, numerous contributions to the faunistics and taxonomy of this group have, in recent years, been made by workers from different parts of the world; notable among them are those of BAYLIS (1919, et seq) from Britain; MEYER (1938), HARTWICH (1954) and SPREHN (1958) from Germany; BAER (1961) from Switzerland; FLORESQUE (1942, et seq) from Rumania;

LOPEZ-NEYRA (1946) from Spain and of BEZUBIK (1956, 1957), FURMAGA (1957) and GRABDA-KAZUBSKA (1962, 1964) from Poland. From North America, CHANDLER (1921, et seq), LINCICOME (1943, 1948, 1949), WARD (1937, et seq), CABLE & FISHER (1954, 1956), CABLE & HOPP (1954) CABLE & QUICK (1954), CABLE & LINDEROTH (1963), CABLE & DILL (1966), CABLE & MAFARASCHISI (1970), BULLOCK (1957, et seq) and HOLLOWAY (1951, et seq) have significantly added to our knowledge of Acanthocephala whereas, VAN CLEAVE's monograph (1953) on the Acanthocephala of North American Mammals has few parallels in the literature on acanthocephalan taxonomy.

From South America, MACHADO FILHO (1941, et seq), SZIDAT (1950) and DIAZ-UNGRIA (1958) and his associates have made outstanding contributions from Brazil, Argentina and Venezuela respectively. Recently a collection of acanthocephala from fishes, birds and mammals of Venezuela has been made available to the present writer through the good offices of Carlos Diaz-Ungria, henceforth referred to Caracas Collection, and some new species and two new genera are being reported from that collection in the present study.

From the eastern region of the Old World, JOHNSTON & BEST (1929, et seq), JOHNSTON & EDMONDS (1947, et seq), EDMONDS (1957, 1964, 1967, 1971) and SNOW (1971) have described many species from the Australian region, whereas TUBANGUI (1931, 1933, 1935) and TUBANGUI & MASILUNGAN (1937, 1938, 1946) have contributed from Philippines. Among the other important Japanese works on Acanthocephala, besides those of YAMAGUTI (op. cit) are those of others like

FUJITA (1920, 1922), FUKUI (1929), FUKUI & MORISHITA (1936, 1937, 1938, 1939), FUKUI & OGATA (1937) and HARADA (1928, 1935, and 1938).

In India, acanthocephalan taxonomy was initiated by CHANDLER (1925) when he described <u>Centrorhynchus erraticus</u> as a new species from a cat in Calcutta. Since then SUBRAHMANIAN (1927, 1936, 1937), THAPAR (1927, 1930), BHALERAO (1932, 1937), VERMA & DATTA (1929), DATTA (1927, et seq), DATTA & SOOTA (1955, 1956), DAS (1949, et seq), SOOTA & SEN (1956), FAROOQI (1958) and more recently,TRIPATHI (1959) have described many new genera and species from Indian vertebrates, mostly fishes. Of significant zoo-geographic and faunistic interest are the studies of KAW (1941, 1951) who has described some species of the genus <u>Echinorhynchus</u> and <u>Pomphorhynchus</u> from the hill-stream fishes of Kashmir and has shown that the acanthocephalan fauna of that region has closer affinities with European fauna than with its tropical counter-part. The genera <u>Neoechinorhynchus</u>, <u>Acanthocephalus</u> and <u>Echinorhynchus</u> occurring mostly in fresh-water fishes and anurans of temperate regions have so far been reported, in the Indian region, from Kashmir only. Some species of <u>Neoechinorhynchus</u> have been collected from tropical India but these species occur in marine or esturine hosts only. The marine fishes of Indian waters have, however, yielded some intere interesting species representing many genera, and in this respect the acanthocephalan fauna of this region appears similar to that of Japan. The collections available to present writer also indicate that the marine fishes of India harbour a rich variety of acantho-cephalan parasites and our knowledge may further increase if more extensive surveys are made.

A Revision of the Orders Eoacanthocephala and Palaeacanthocephala (Acanthocephala) Parasitic in Fishes, Birds and Marine Mammals.

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C O N T E N T S

Of other global faunistic studies worth special mention are those of VAN CLEAVE (1920, et seq) from Venezuela, China, Japan and India and the Antarctic region; of LEIPER & ATKINSON (1914, 1915), BAYLIS (1929) and EDMONDS (1955, 1957) from the Antarctic region and eastern Pacific; of GOLVAN (1956, 1957, 1958, 1969), DOLLFUS (1929, 1951, 1957) , DOLLFUS & GOLVAN (1956) and TRNCY (1970) from the North and mid-west Africa and of KHALIL (1970) from Sudan and the White Nile basin. In the Far East, SCHMIDT & KUNTZ (1965, et seq) have, in recent years, published extensive studies on the Acanthocephala of vertebrates of Formosa (now Taiwan), Philippines and some other adjoining islands.

A review of these studies, however, indicate that relatively little is known of the acanthocephalan fauna of the world and many regions are still unexplored. In North America, although numerous studies have been made on the mainland U.S. and on the eastern cost, little has been investigated on the west-coast which, otherwise, abounds in marine as well as terrestrial fauna. The studies of VAN CLEAVE (1940), MARGARITA BRAVO-HOLLIS (1946, 1948) and MARTIN & MULTANI (1968) provide a good indication in this regard. Similarly a few surveys on the northern coast of Africa, Senegal, Chad, Nigeria and Sudan have yielded significant results still much can be speculated in the tropical and sub-tropical region of that great continent.

In the Neotropical realm investigations have been mostly confined to Brazil, and a few to Argentina and Venezuela whereas most of the continent is still unexplored as afar as the Acanthocephala are concerned. Similarly, although some studies have been made on the faunistics of the Acanthocephala of the Antarctic region (EDMONDS, 1956, 1957; LEBEDEV, 1967; DEMSHIN, 1965), nothing is known nor has ever been investigated in this field in the vast expanse of Oceania and Micronesia where prolonged geographical isolation should have given rise to marked speciation in the parasi populations too.

Notwithstanding, all these studies have substantially add to the systematics of the Acanthocephala, which, having already been subject to various taxonomic considerations over the year now need a comprehensive and consistent systematic evaluatio Accordingly an effort is being made in the present study to re and re-evaluate, as far as possible, the present systems of classification among which the one of Van Cleave appears more acceptable than the other systems. A revised scheme, which is followed in the present study is being presented and discussed later (Chapter V).

III. MATERIAL AND METHODS

The material on which the present study is based was obtained either from the host specimens or as preserved collections from various sources. Type specimens from various individuals or from the reference collections of different Institutions were mostly permanent mounts except in a few cases where the specimens were preserved in formalin and were remounted for the present study.

Specimens obtained fresh and alive from their respective hosts were first soaked in tap-water until their proboscides had completely everted and were then fixed in Mossman's A.F.A fixative, or in case of large and thicker worms, in alcoholic Bouin's fluid. They were then washed with 70% alcohol, dehydrated, stained with Grenacher's borax-carmine and cleared in xylene. Prior to their permanent mounting, dealcoholised specimens were gradually transferred to a series of xylene-balsam mixture (75:25, 50:50, 25:75 v/v) until they were completely impregnated with the mounting medium. This procedure eliminated the hazard of the worms usually turning opaque when mounted. Specimens so processed were finally mounted in synthetic Canada Balsam which was found more suitable than the natural resin as far as acanthocephalan worms are concerned. Some specimens were also stained with Delafield's Haematoxyline but the results thus obtained, though satisfactory, were no so good as those obtained through borax carmine.

It is further noticed, and is recommended, that acanthocephalan worms should be preserved for some time even after fixation, preferably for a few days before staining; anyway they should not preferably be stained soon after fixation with any of these dyes since the latter invariably react with the lipoid contents of the body fluids present in pseudocoel or in the lacunar mesh and at times form precipitates which render the finer details of internal organs obscure.

Small and medium sized worms were also cleared and temporarily mounted in glycerine or in lactophenol. Beechwood-creosote was found to be a better clearing agent for worms with a thicker cuticle. These reagents were also found more suitable for study as precise measurements of proboscis hooks and of some other structures too could be taken without flattening the worms; all-the-more they imparted transparency to delicate worms in which structures appear superimposed if the specimens are compressed. Posterior extremities of gravid females were slit open to have the eggs released; in medium-sized worms the female genital tract was dissected out and in utero eggs were preferably measured since it has been ascertained that eggs contained within the uterus are perfectly mature and ready for release whereas those contained in the pseudocoel fluid are mostly immature and in developing stages (WHITFIELD, 1970). Such eggs were observed in 4% formaline; aromatic media tend to shrink the inner egg-shell membranes.

Diagrams of such specimens, as well as of those obtained from other sources were drawn with the aid of a camera-lucida. In case of larger forms, the diagrams were drawn by micro-prjection method. In such cases the proboscis hooks were, however, measured either by ocular micrometer or were drawn to scale by means of a camera-lucida. Excessively large diagrams were reduced through pantography.

In case of marine fish parasites, numerous fishes were examined from various Indian coastal localities whereas Dr. Ather H. Siddiqi had examined a larger number of marine fish specimens from Nigerian waters during 1965-1968 and these fishes have yielded two new and two previously known acanthocephalan species. The latter are, however, new host and distribution records from Nigeria since these species were originally reported from elsewhere in Africa.

All measurements are in millimeters and the location of the parasite small intestine unless otherwise mentioned. The letter 'u', wherever cited, stands for the Greek alphabet 'µ' _ the symbol of the unit Micron.

(IV)

Order Eoacanthocephala VAN CLEAVE, 1936

Suborder Gyracanthocephala VAN CLEAVE, 1936

Family Acanthogyridae THAPAR, 1927

1. Genus Acanthogyrus THAPAR, 1927, emend.

Generic diagnosis : Acanthogyridae of small size. Body slender, spinose; cuticular spines extending posteriorly upto the genital pore. Proboscis beset with 3 successive rows of 4-8 hooks each. Lemnisci elongate, digitiform or spatulate; longer than the receptacle. Testes tandem, post-equatorial. Cement gland single, syncytial. Cement reservoir with single efferent duct. Accessory vesicles present. Bursa without bursal rays. Uterine bell goblet-shaped. Female genital pore sub-terminal, with two spherical sphincters. Eggs thin shelled. Parasitic in fresh-water carps.

Type species : Acanthogyrus acanthogyrus THAPAR, 1927.

(i) Acanthogyrus thapari n.sp

(Pl. I, Fig. 1-6)

Description based on 8 specimens (3 males, 5 females) with characters of the genus. Body slender, fusiform, dorsally curved; males smaller than females. Proboscis spherical or sub-spherical (in females particularly). Proboscis hooks variable in number; 4 in the apical or anterior circle and 8 each in the middle and the basal circle *.

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* : The hooks of the three respective circles, and their corresponding roots are henceforth indicated as Hi, Hii, Hiii and Ri, Rii and Riii respectively.

Uterine bell goblet-shaped, 0.12 x 0.2 mm. Uterus fusiform, with thich muscular walls, 0.35 mm long, 0.09 mm wide in the middle. Vaginal sphincters tandem, 0.05 mm in diameter. Vagina 0.1 mm. Genital pore sub-terminal. Eggs 40 x 20 u.

Type host : Schizothorax sp. (Cyprinidae)

Type locality : Sopore, Kashmir.

Holotype male, allotype female and 6 paratypes deposited in the Zoological Museum, AMU, Aligarh.

The genus Acanthogyrus was created by THAPAR (1927) to include the type and the only species, A. acanthogyrus. Subsequently, three more species, namely, A. nigeriensis DOLLFUS & GOLVAN, 1956, A. partispinus FURTADO, 1963 and A. tripathii RAI, 1967 were ascribed to this genus. Acanthogyrus thapari closely resembles A. acanthogyrus and A. nigeriensis in certain aspects but can be distinguished from both these species in the number of proboscis hooks and in the arrangement of trunk spines.

A. tripathii RAI, 1967 does not differ from A. acanthogyrus in any appreciable extent. Comparison of the types of the former (RAI material from Mathura Veterinary College Parasite Collection) with the type specimens of the latter (ZSI Collection, Indian Museum, Calcutta; No : W 5252/1 - holotype male, and W 3803/1, paratype male) indicate their close resemblance with each other. A. tripathii RAI, 1967 is, therefore, considered a junior synonym of A. acanthogyrus THAPAR, 1927. Further, A. partispinus FURTADO, 1963, in having only 4 or 5 transverse rows of proboscis hooks and a few circular rows of trunk spines confined to the anterior 2/3 of the body length concurs with the concept of the genus *Raosentis* DATTA, 1947 and is, therefore, transferred to that genus , being renamed as *Raosentis partispinus* (FURTADO, 1963) comb. nov.

Acanthogyrus thapari n. sp. is named after Prof. G.S. Thapar, the founder of the genus, in appreciation of his contribution to the taxonomy of Indian acanthocephala.

Key to species of the genus *Acanthogyrus*

(1) Number of proboscis hooks constant, 8 in each transverse (circular) row .... *A. acanthogyrus*

Number of proboscis hooks variable .... (2)

(2) 2 large apicals; trunk spines in uniform circular rows in a single field .... *A. nigeriensis*

4 large apicals; trunk spines in two successive spinose fields .... *A. thapari*.

2. Genus *Acanthosentis* VERMA & DATTA, 1929

Generic diagnosis : Acanthogyridae; body small, slender. Proboscis short, oval or spherical, with three transverse rows of six hooks each. Trunk spines minute, confined to the anterior 1/4 of body length. Proboscis receptacle single-layered with cerebral ganglion either at base or in front of it. Hypodermic nuclei few, large, median. Testes tandem, pre- or post-equatorial. Cement gland syncytial with single efferent duct of the reservoir.

Bursa simple, without bursal rays. Female genital pore ventro-teminal. Eggs thin shelled. Parasites of fishes (mostly fresh-water).

Type species : Acanthosentis antispinus VERMA & DATTA, 1929.

(1) Acanthosentis pauciuncinatus n. sp

(Pl. II, Fig. 7-11)

Description based on 6 specimens (2 males, 4 females) with characters of the genus. Body elongate, slender, broader in the anterior middle and tapering at extremities. Proboscis ovoid spherical, armed with 3 circular / transverse rows of 6 hooks each; Hi = 50 u, Ri = 40 u; Hii = 40 u, Rii = 25 u; Hiii = 25 u, Riii = 15 u. Neck short, conical. Fore-trunk beset with 8-10 circular rows of of minute spines. Proboscis receptacle elongate, sub-cylindrical with cerebral ganglion in front of its base. Lemnisci elongate, fusiform; one uni-nucleate, the other binucleate.

Male : 4.5 - 5.0 x 0.5 - 0.7 mm. Proboscis 0.09 x 0.08 mm. Neck truncated, broader at base, 0.1 - 0.13 x 0.13 mm. Trunk spines confined to the anterior 4/5 of the body length; in 10 circular rows of about 30 minute spines in each row, each spine about 5 u long. Proboscis receptacle 0.5 - 0.6 x 0.13 mm. Lemnisci almost equal, each 1.25 x 0.07 mm.

Testes oval, tandem, sub-equal; anterior 0.40 x 0.32 mm, posterior one 0.57 x 0.32 mm. Cement gland syncytial, laterally indented, 0.5 x 0. 28 mm. Cement reservoir claviform, 0.15 in diameter in the broad anterior region. Seminal vesicle pyriform, 0.65 x 0.13 mm. Saefftigen's pouch 0.52 x 0.07 mm. Bursa 0.47 mm long, bursal cap dome-shaped, without bursal rays.

Female : 10.0 - 12.0 x 1.1 - 1.2 mm. Proboscis eellipsoidal, 0.1x0.08 mm. Number, size and arrangement of proboscis hooks and trunk spines same as in males. Neck 0.14 x 0.16 mm at the base. Proboscis receptacle 0.6 x 0. 13 mm.

Female genital tract in the posterior 1/6 of the trunk. Genital pore of female sub-terminal. Vagina with two tandem sphincters, each 0.05 mm across. Uterine bell deep, sub-cylindrical, 0.16 mm long, 0.12 mm wide distally, 0.07 mm proximally. Eggs thin-shelled, each about 30 u long, 10 u wide.

Type host : Rita rita HAMILTON-BUCHANAN (Bagridae)
Type locality : Hoshangabad, M.P. (on the river Narmada).
Type specimens (holotype male, allotype female and 4 paratypes deposited in the Zoological Museum, AMU, Aligarh.

Of the ten species in the genus Acanthosentis, the present one, i.e. Acanthosentis pauciuncinatus , n. sp., closely resembles A. holospinus SEN, 1938 and A. giuris SOOTA & SEN, 1954 but differs from both in the average body size and the extent of trunk spination. In the latter two species circular rows of trunk spines extend well upto the testicular field in males and upto, or slightly beyond the anterior middle of the body length in females, whereas in A. paucivncinatus the rows of trunk spines do not extend beyond the level of the posterior margin of the lemnisci.

Moreover the trunk spines of A. pauciuncinatus are relatively less in number and smallest in size among all the known species in the genus Acanthosentis. From A. giuris , the present species further differs in the form of the uterus also which is comparatively longer, tenuous and recumbent in the former but short and fusiform in the latter.

Acanthosentis betwai TRIPATHI, 1959 , A. hilsi PAL, 1963 and Acanthosentis thapari PAL et al, 1969 are conspecific with each other and have been suggested as junior synonyms of the type species, Acanthosentis antispinus by GUPTA & KAKAJI (1969) whereas A. thapari PRASAD et al, 1969 does not differ to any significant extent from Acanthosentis indica TRIPATHI, 1959 and is, therefore, regarded as a junior synonym of the latter.

Key to species of the genus Acanthosentis

(1) Apicals more than 50 u in length .... (2)
Apicals about 50 u in length .... (4)
Apicals less than 50 u in length .... (6)

(2) Apicals 55 u each, lemnisci un-equal .... A. sircari
Apicals larger than 70 u, lemnisci equal .... (3)

(3) Apicals 80 u each or slightly larger, trunk spines confined to for trunk only; parasitic in marine fishes .... A. acanthuri
Apicals 70 u long each, trunk spines upto the middle of the body length; in fresh-water fishes .... A. antispinus

Family Pallisentidae VAN CLEAVE, 1928

1. Genus Pallisentis VAN CLEAVE, 1928

Synonyms : = Neosentis VAN CLEAVE, 1928 (syn. fide - HARADA, 1935 : 9)

= Farzandia THAPAR, 1930 (syn. fide BAYLIS,1933 : 448).

= Saccosentis TADROS, 1966 : new synonymy.

= Devendrosentis SAHAY, SINHA & GHOSH, 1971 : new synonymy.

Generic diagnosis : Pallisentidae of medium or small size with elongate, cylindrical or fusiform spinose trunk. Proboscis sub-globular, with 4 circul r rows of hooks gradually decreasing in size antero-posteriorly. Neck long, cylindrical, aspinose. Proboscis receptacle elongate, sub-cylindrical with cerebral ganglion usually in its anterior middle. Trunk spines relatively larger, Y-shaped, deep-set in the hyposermis; disposed in two distinct spiniose fields seperated from each other by a short but distinctly smooth gap. Spines more numerous in anterior girdle than in posterior transverse rows. Lemnisci elongate, tubular. Hypodermic nuclei oval or amoeboid. Testes elongate oval or ellipsoidal, tandem or contiguous, pre- or post-equatorial. Cement gland elongate, syncytial, with a variable number of large nuclei. Cement reservoir usually pyriform, partly overlapped by the posterior inded margin of the cement gland. Efferent cement ducts paired. Saefftigen's pouch large, pyriform. Genital pore of female sub-terminal. Eggs with thick outer shell. Parasites of fresh-water fishes, mostly murrels.

Type species : Pallisentis umbellatus VAN CLEAVE, 1928.

(1) Pallisentis umbellatus VAN CLEAVE, 1928

(Pl. III, Fig. 12-16)

Pallisentis umbellatus VAN CLEAVE, 1928 is being redescribed since its original description is inadequate. The redesription is based on the re-examination of the following type specimens from US National Museum Helminthological Collection No : 37608 :

Paratype male No 2067.1 , Van Cleave collection,
Paratype male No 2067.3 , Van Cleave collection,
Paratype female 2074.2 , Van Cleave collection,
Paratype male No 2067.6 , Van Cleave collection, all specimens from type host and type locality.

Body elongate, slender, broader in the anterior middle. Proboscis sub-globular, armed with 4 circular rows of 6 hooks each. Hi = 90 - 120 u (90 u), Ri = 50-60 u (50 u) ; Hii = 80- 100 u (75 u), Rii = 45 u (45 u) ; Hiii = 50-65 u (50 u) , Riii = (25 u) ; Hiii = Hiv = 35-40 (30 u) , Riv = (15-18 u). (Figures in parentheses pertain to the paratype specimens). Neck relatively short, truncate conical. Lemniscis tubular, elongate, curled, each about 2 mm long. Trunk spines in 9 circular rows of 18-24 spines each in the anterior girdle and in about 26 rows of 18 each in mid-posterior girdles, thence gradually decreasing in number and dwindling in posterior 1/3 of body length region. Spines of anterior girdles small, close-set, each about 10 u long; of posterior girdles/ region large, wider apart; each about 24 u long.

Male : 10.0 - 12.0 x 0.4 mm. Proboscis sub-globular, 0.18 x 0.21 mm. Neck broad at base, 0.12 x 0.25 mm. Proboscis receptacle 0.9 x 0.17 mm with cerebral ganglion anterior to its base. Testes oblong, tandem, post-equatorial, each 1.2 x 0.3 mm. Cement gland elongate, syncytial, 1.8 x 0.17 mm with 10 - 12 large oval or spherical giant nuclei. Cement reservoir pyriform, 0.6 x 0.15 mm, with paired efferent ducts. Seminal vesicle elongate, fusiform, 0.9 mm in length. Saefftigen's pouch 0.8 x 0.1 mm. Bursa fan-shaped when everted; total length of bursa 0.9 mm. Bursal cap 0.31 x 0.26 mm. Penis conical, papillaeform.

Female (paratype) : Trunk fusiform, 10.0 x 0.5 mm. Proboscis sub-spherical, 0.2 mm wide in the middle; number and size of hooks same as in male. Neck slightly short, truncated. Proboscis receptacle 0.75 x 0.25 mm. Genital pore of female sub-terminal. Vagina 0.1 x 0.003 mm, with two tandem vaginal sphincters, each about 20 u in diameter. Uterus claviform, 0.25 mm long, 0.08 mm in max width in the middle. Uterine bell short, cup-shaped, 0.1 x 0.08 mm. Eggs (in allotype female) 76 x 24- 30 u each.

Type host : Ophiocephalus argus CANTOR (Ophiocephalidae).

Other hosts : Siniperca chuatsi BASILEWSKY, (Serranidae), Silurus asotus LINNEUS (Siluridae) and Misgurnus anguillicaudatus (CANTOR) = Cobitus decemcirrosus BERG (Cobitidae).

Type locality : Wuchang., China

Other localities : Peking, China.

Type specimens : in Helminthological Collection of US National Museum, USDA, Beltsville, Md.

(ii) *Pallisentis fragilis* n. sp.

(Pl. IV, Fig. 17-24)

Material pertaining to the present species was forwarded to the present author by Mr. Somkuan Darntrakul, Royal Thai Army Medical Research Institute, Bangkok, Thailand.

Description based on three specimens (2 males, 1 female) with characters of the genus. Body small, slender, ventrally arcuate, tapering at extremities. Females slightly larger than males. Proboscis sub-spherical, armed with 4 transverse rows of 10 hooks each. Hi = 90 u, Ri = 60 u; Hii = 80 u, Rii = 60 u; Hiii = 40 u, Riii = 25 u; Hiv = 25-30 u, Riv = 20 u. Roots of apicals characteristically provided with 2-3 manubrial sclerites converging at the apex. Neck relatively long, sub-cylindrical, slightly expanded at the base. Trunk spines relatively large, Y-shaped, distal prongs further bifid; in 14 close-set circular rows of 10-12 spines each in the anterior girdles and in about 20 transverse rows in the posterior girdle, the number of spines in each row varying from 12 - 16. Spines of anterior rows about 12 u long each with root prongs about 8 u in length on each side. Proboscis receptacle sub-cylindrical with cerebral ganglion anterior to its middle.

Male : 4.65 x 0.32 mm. Proboscis 0.13 x 0.13 mm. Neck 0.18 mm long, 0.1 mm wide at base, 0.08 mm elsewhere. Proboscis receptacle 0.5 x 0.1 mm. Lemnisci elongate, filiform, curled, each about 0.95 mm long, 0.06 mm wide. Testes pre-equatorial, nearer proboscis receptacle, tandem, sub-equal, 0.7 x 0.1 and 0.6 x 0.07 mm each.

Cement gland elongate oval, syncytial, 0.6 x 0.09 mm, with 9-10 large nuclei. Cement reservoir pyriform, 0.33 x 0. 15 mm, with paiired efferent ducts. Seminal vesicle fusiform, 0.5 mm long. Saefftigen's pouch pyriform, 0.4 x 0.09 mm. Bursal cap dome-shaped, 0.15 x 0.12 mm. Total length of bursa 0.5 mm.

Female : body 6.25 x 0.5 mm with maximum width in the anterior middle of the fore-trunk. Proboscis ovoid-spherical, 0.25 x 0.22 mm. Number and size of hooks same as in males. Neck 0.24 mm long, 0.38 mm wide at base. Proboscis receptacle 0.65 mm long, o.2 mm wide. Lemnisci filiform, equal, each 0.1 mm long. Female genital pore sub-terminal. Vagina 0.05 mm. Vaginal sphincters tandem, each about 40 u in diameter. Uterus short, fusiform, 0.15 x 0.07 mm. Uterine bell 0.1 x 0.09 mm. Eggs thin shelled, 30 x 15 u each.

Type species : <u>Ophiocephalus</u> sp.

Type locality : Thonburi, SW Thailand.

Holotype male, allotype female and one paratype male deposited in the Helminthological Collection, Zoological Museum, AMU, Aligarh.

<u>Pallisentis</u> <u>fragilis</u> n. sp can be distinguished from all the known species of the genus through the presence of manubrial sclerites and in the position of male gonads. It comes close to <u>Pallisentis</u> <u>basiri</u> FAROOQI, 1958 and <u>P</u>. <u>buckleyi</u> TADROS, 1966 in its general appearence but differs from these two species in the arrangement of trunk spines, location of the testes in anterior 1/4 of the trunk, and in having a short fusiform uterus, a condition characteristic of <u>P</u>. <u>fragilis</u> only. In all the other known species

in the genus *Pallisentis* the testes are post-equatorial but in *P. fragilis*, the new species, they are located in the anterior 1/4 th of the trunkand the lemnisci almost reach the anterior testis.

Pallisentis buckelyi TADROS, 1966 resembles *P. basiri* very closely and has been recorded from the same (type) locality as of the latter. The measurements of almost all the structures of the two species are also within overlapping range. Consequently it is contended that *P. buckleyi* TADROS, 1966 be regarded as a junior synonym of *P. basiri* FAROOQI, 1958.

Pallisentis fragilis n. sp is the first valid acanthocephalan species which is being recorded from Thailand. Previously PEARSE (1933) had made a preliminary report of the occurrence of certain helminth parasites in the fishes of Thailand (then Siam) and in that report he had briefly mentioned the occurrence of immature forms (possibly juveniles) of *Farzandia* sp (a synonym of the genus *Pallisentis*) in the murrels - *Ophiocephalus* sp. of Bangkok. It is quite likely that what PEARSE (1933) would have come across may have been either *P. ophiocephali* THAPAR or the present species or some other closely resembling form. The acanthocephalan fauna of Thailand is very scantily known and it might be speculated that the fresh-water fishes of that country might be having the same parasite heritage what the fishes of Indian region have. Further faunistic investigations in this field should surely be interesting and fruitful.

(iii) Pallisentis major n.sp.

(Pl. IV, Fig. 25-30)

Numerous speciemns representing a new species in the genus Pallisentis were collected from 3 host specimens of Rita rita and 1 specimen of Xenotodon sp. procured at a fish-landing site on the river Narmada near Bhopal, M.P. The specimens on which the description of the species is based were selected from those obtained from the former host species.

Body medium sized, elongated, anteriorly broad at the level of the base of proboscis receptacle thence gradually tapering posteriorly. Proboscis knob-like, set off from the neck, broader than long; beset with 4 transverse rows of 8 hooks each. Anterior (apical) hooks short, stout, broad, wedge-shaped with thick-set roots. Hi= 75 u, Ri = 70 u; Hii = 65 u, Rii=55 u; Hiii = 50 u, Riii = 35 u; Hiv = 30 u, Riv = 30 u. Proximal region of apicals hooks with a distinct ventral notch at the confluence of the blade and its corresponding root. Neck relatively short as compared to the size of the body. Lemnisci long, tubular, each about 2 mm long. Trunk spines short, thick-set, with short posterior prongs; the free end of each spine projecting through a cuticular extension of the trunk region. Anterior girdle with 15 circular rows of 20 spines each; posterior rows sparse, incomplete, wider apart with relatively few spines in each; the spines gradually decreasing in size also. Spines of posterior region simple with simple prongs. No spines in the posterior 1/3 of the trunk in either sex.

Male : Body 16.55 x 0.75 mm. Proboscis 0.2 mm long, 0.32 mm wide. Neck 0.36 mm long, 0.2 mm wide anteriorly, 0.25 mm posteriorly at the base. Proboscis receptacle 0.5 x 0.35 mm. Testes elliptical elongate, in the posterior 1/3 of the trunk, tandem but moderately seperated from each other, more or less equal in size, 1.12x0.15 mm each. Cement gland elongate, syncytial, saccate, 2.17 x 0.2 mm. Vesicula seminalis 0.8 mm long. Saefftigen's pouch fusiform, 0.6 x 0.2 mm. Bursal cap dome-shaped, 0.4 x 0.3 mm. Total length of bursa 0.7 mm.

Female : Body longer than that of males; 22.0 - 26 x 0.8 mm. Proboscis 0.35 mm long, 0.55 mm broad in the middle. Number and size of proboscis hooks and of trunk spines same as in males and as mentioned above. Proboscis receptacle 0.55 x 0.4 mm. Neck 0.3-0.4 mm long.

Female genital pore ventro-terminal. Vagina 0.13 mm long. Vaginal sphincters tandem, sub-equal, anterior larger than the follewing one; 25 and 40 u in diameter respectively. Uterus long, tubular, 0.8 x 0.15 mm. Uterine bell deep, cylindrical, U-shaped. 0.55x0.2 mm. Eggs large, 90 u x 45 u each, with thicker outer shell.

Type host : Rita rita HAMILTON-BUCHANA - (Bagridae)
Other host: Xenotodon sp. - (Xenotodontidae).
Type locality : Tawa on the river Narmada (M.P).
Type specimens (holotype male, allotype female) deposited in the Zoological Museum, AMU, Aligarh. Paratypes in the collection of the author.

Pallisentis major n. sp differs from the other so far known species in this genus in its body size, shape of the proboscis hooks, the location of the testes in the posterior 1/3 of the trunk and in the extent of the trunk spines in both sexes. In the last named aspect it, however, comes closer to *P. nagpurensis* - BHALERAO, 1931 but differs from the latter in the location of testes in males and in the nature of uterine bell in females. So far as size in concerned, *P. major* is perhaps the largest species in the genus.

Key to species of the genus Pallisentis.

(1) Proboscis armed with 4 circles of 6 hooks each .... *P. umbellatus*

Proboscis armed with 4 circles of 7 hooks each, cement gland large, saccate, bipartite......... *P. nesteri* (TADROS)

Proboscis armed with more than 7 hooks each .... (2)

(2) 10 hooks in each of the 4 transverse rows .... (3)

9 hooks in each of the 4 transverse rows .... *P. basiri*

8 hooks in each of the 4 transverse rows .... (4)

(3) Apicals with large manubrial sclerites ...... *P. fragilis*

Apicals without manubrial sclerites .... (5)

(4) Trunk spines extending the entire body region, testes oval, in mid body region .... *P. ophiocephali*

Trunk spines not extending beyond the anterior 1/2 of the trunk, testes ellipsoidal, in posterior 1/3 of trunk.... .... *P. major*

Trunk spines extending upto posterior 1/3 of body length, testes anterior to middle of the trunk .... *P. nagpurensis.

(5) Apicals 90 u or less each, lemnisci grossly un-equal, testes in mid body region .... *P. nandai*

syn.: (= *P. colisai*), hoc loco.

Apicals less than 90 u each, lemnisci equal, testes in posterior 1/3 of the trunk .... *P. gabeous*.

* *Devendrosentis garuai* SAHAY, SINHA & GHOSH, 1971 conforms with *Pallisentis nagpurensis* (BHALERAO, 1931) in all its essential details and measurements and has, therefore, been considered a junior synonym of the latter. The reasons for the synonymy of the genus *Devendrosentis* SAHAY, et al (1971) with *Pallisentis* have been discussed in Chapter V.

Family Quadrigyridae VAN CLEAVE, 1920

Genus *Quadrigyrus* VAN CLEAVE, 1920.

Generic diagnosis : Quadrigyridae of medium or small size. Body elongate, fusiform. Proboscis globular, armed with 4 transverse rows of 5 hooks each. Fore-trunk beset with cuticular spines disposed in 4-6 circular rows. Lemnisci broad digitiform, longer than the receptacle. Hypodermic nuclei in anterior trunk-region oval or elliptical, those of posterior half characteristically very large and dendritic, situated along the longitudinal axis of the body. Testes tandem, oval or elliptical, pre- or post-equatorial. Cement gland syncytial with single efferent duct.

Parasites of Neotropical fresh-water fishes. Distribution restricted.

Type species : Quadrigyrus torquatus VAN CLEAVE, 1920.

The genus Quadrigyrus includes the two species, Q. torquatus VAN CLEAVE, 1920, the nominal type and Q. brasiliensis MACHADO FILHO, 1941 ; the third, Q. cholodkowski KOSTYLEW, 1928 does not belong to the genus Quadrigyrus but, for reasons discussed later (Chapter V), in the genus Acanthocephalorhynchoides KOSTYLEW, 1941. It is, therefore, assigned to the latter genus and is renamed Acanthocephalorhynchoides cholodkowski (KOSTYLEW,1928) comb. nov.

The original description of Q. torquatus is inadequate also. Availability of type specimens from US National Museum (Van Cleave Collection) and additional material from the type locality - Lake Valencia, Maracay, Venezuela, through the courtesy of Dr. Carlos Diaz-Ungria, Caracas, has enabled the writer to furnish a detailed redescription of this species. It is based on the following material :

(1) US National Museum Helminthological Collection :
Cotype male No: VC 2737, Accession No: 37671,
Cotype male No: VC 1227.7, Accession No: 37671,
Cotype female No: Vc 1227.10, Accession No: 37671,
(all specimens from type host and type locality),

(2) Caracas Collection No. 1431, 3 males and 2 females, also from type host and type locality.

(i) Quadrigyrus torquatus VAN CLEAVE,1920.

(Pl. V. Fig. 31-37)

Body fusiform or cylindroid, broader anteriorly thence tapering posteriorly. Proboscis globular, armed with 4 circular rows of 6 hooks each; Hi = 94 - 106 (100) u, Ri = 47-53 (50) u; Hii = 76-100 (90) u, Rii = 50-55 (50) u; Hiii = 53-59 (60) u, Riii = 24-30 (30) u; Hiv = 41 - 47 (40) u, Riv = 12-24 (20) u. (Figures in parentheses pertain to topotype specimens in Caracas Collection). Neck short, truncate conical, broader at base. Fore-trunk beset with 4 circular rows of 12 spines each. Lemnisci elongate, spatulate, fusiform, longer than the receptacle. Anterior hypodermic nuclei oval or elliptical, laterally disposed, each about 20 u long. Posterior hypodermic nuclei larger, dendritic, each with a median stem and several short, stumpy lateral projections directed laterally and anteriorly.

Male : 7.5 - 10.0 x 0.75 - 1.0 mm, with maximum width in the anterior region at the level of the proboscis receptacle. Proboscis 0.15 mm in diameter. Neck 0.15 mm long, 0.2 mm wide at the base. Trunk spines minute, each about 20 u long. Proboscis recep - tacle elongate, sub-cylindrical, o. 55 x o.15 mm. Lemnisci equal, each 0.75 x 0.15 mm.

Testes elongate, elliptical, post-equatorial in mature individuals, tandem, contiguous or slightly wide apart, each about 0.65x0.22 mm. Cement gland large, elongate, syncytial, 1.55 x 0.25 mm.. Cement reservoir voluminous, spheroidal, 0.38 x 0.3 mm. Saefftigen's pouch elongate pyriform, 0.65 mm in length.

Seminal vesicle 0.55 mm long. Bursal cap crateriform, 0.7x0.5 mm; total length of bursa 0.75 mm. Penis large, papilliform conical, 0.1 mm long.

Female : Sexual dimorphism distinct; females larger than males; 10.0 - 20.00x 0.9 - 1.25 mm in maximum width anteriorly. Size and shape of proboscis, proboscis hooks, neck, and arrangement of trunk spines same as in males. Dendritic posterior hypodermic nuclei larger, upto 200 u long in tpotype male.

Uterine bell vase-shaped, 0.25 x 0.08 mm. Uterus long, tubular and relatively thin-walled, 0.65 x 0.9 mm. Vaginal funnel 0.15 mm long. Vagina ventral, sub-terminal, 0.05 mm in length. Anterior vaginal sphincter 0.15 mm, posterior one 0.2 mm in diameter. Eggs thin-shelled, each 75 x 35 u.

Type host : Hoplias malabaricus (BLOCH) - Characinidae.

Other hosts : Astyanax bimaculatus (LINNEUS) , Gephyrocharax - valenciae EIGENMANN - (Characinidae) , Symbranchus marmoratus BLOCH - (Symbranchiformes), Crenicichla geayi PELLEGRIN -(Cichlidae).

Type locality : Lake Valencia, Maracay, NW Venezuela.

Distribution : Venezuela (VAN CLEAVE, 1920 ; DIAZ-UNGRIA & RODRIGO, 1957, 1958, 1959) , Brazil (MACHADO - FILHO, 1941).

Type specimens : Holotype, allotype, various cotypes and paratypes in Van Cleave Collection in US National Museum Helminthological Collection with Accession No. 2737. Topotypes in Caracas Collection No 1431.

(ii) Quadrigyrus brasiliensis MACHADO FILHO,1941.

(Pl. V. Fig. 38-40)

The Caracas Collection No. 1431 also contained 3 specimens of Q. brasiliensis (2 males, 1♀) from Hoplias malabaricus of Lake Valencia, Maracay, Venezuela. This is the first record of the occurrence of this parasite species in Venezuela, previously it was reported from Brazil only.

The specimens conform in all essential details and in measurements with the original description.

Key to species of the genus Quadrigyrus

1 (a) Fore-trunk with 4 transverse rows of spines ; testes post-equatorial, Cement gland relatively small : 1/6 of body length .... Q. torquatus.

1 (b) Fore-trunk with 3 transverse rows of spines; testes pre-equatorial. Cement gland voluminous and longer, 2/3 of body length .... Q. brasiliensis.

Suborder Neoacanthocephala VAN CLEAVE, 1936

Family Neoechinorhynchidae VAN CLEAVE, 1916

Subfamily Neoechinorhynchinae TRAVASSOS, 1926

1. Genus *Neoechinorhynchus* HAMANN, 1905.

Synonyms : = *Neorhynchus* HAMANN, 1892, nec SCLATER, 1869, non MILNE-EDWARDS, 1879.

= *Eorhynchus* VAN CLEAVE, 1914 (Syn. fide VAN CLEAVE, 1916).

= *Eosentis* VAN CLEAVE, 1928 (Syn. fide KAW, 1951)

= *Dendronucleata* SOKOLOVSKAYA, 1967 : Syn. hoc loco.

= *Dispiron* BILQEES, 1970 (Syn. hoc loco).

Generic diagnosis : Neoechinorhynchidae of medium or small size. Proboscis short, globose or oval, armed with 3 transverse or diagonal rows of 6 hooks each, terminal or apical hooks (Hi) larger than rest. Neck distinct and smooth. Trunk non-spinose. Hypodermic nuclei usually six ; 5 dorsal and 1 ventral. Lemnisci elongate, slender or fusiform, equal, sub-equal or grossly dissimilar in length; one of them uni-nucleate, the other binucleate. Proboscis receptacle single layered, inserted posteriorly to the basal circle of hooks. Testes tandem, oval, elliptical or elongated; pre-equatorial or post-equatorial. Cement gland single, syncytial, with a variable number of large nuclei. Cement reservoir pyriform with paired efferent ducts. Vaginal sphincters tandem. Vaginal opening ventro-terminal. Eggs thin-shelled. Parasites of fishes.

Type species : *Neoechinorhynchus rutili* (MULLER, 1780).

(i) *Neoechinorhynchus acanthuri* n.sp.

(Pl. VI. Fig.41-45)

Description based on 2 male specimens only.

Male : Body small, fusiform, 4.65 x 0.7 mm with maximum width at the middle of the body length. Proboscis globular, 0.1 x 0.1 mm; Hi = 70 u, Ri = 35 u; Hii = 25 u, Rii = 12 u ; Hiii = 20 u, Riii = 12 u. Neck short, attenuated (partly invaginated in both specimens). Proboscis receptacle elongated elliptical, constricted in the posterior 1/3 of its length ; 0.35 x 0.15 mm. Cerebral ganglion oval, 75 u long, basal in location. Lemnisci filiform, equal in length, each 1.0 x 0.075 mm. Hypoderm about 10 u thick. Hypodermic nuclei large, elliptical. Testes oval, equal, tandem ; post-equatorial, each 0.35 x 0.2 mm. Cement gland large, oval, posteriorly indented, 0.55 x 0.33 mm with 6 large spherical nuclei. Cement reservoir spheroidal, 0.2 x 0.15 mm. Efferent cement ducts paired, each about 0.6 mm long. Saefftigen's pouch pyriform, 50 x 10 u. Seminal vesicle 0.3 mm long. Penis papilliform. Bursal cap 0.15 mm in diameter. Total length of bursa 0.4 mm.

Female : not known.

Type host : *Acanthurus mata* FORSKAL - (Acanthuridae).

Type locality : Karwar , India.

Holotype male and 1 paratype deposited in Zoological Museum, AMU, Aligarh.

Neoechinorhynchus acanthuri , the new species, closely resembles *N. elongatus* TRIPATHI, 1959 but differs from the latter in the size of the proboscis hooks and in the extent of the lemnisci which extend half way between the base of the receptacle and the anterior testis in the males.

<u>(ii) Neoechinorhynchus mollissimus n. sp.</u>

(Pl. VII, Fig.51-57)

Description based on 9 specimens (2 males, 7 females) with characters of the genus. Body fairly long, slender, filiform with distinct sexual dimorphism ; females being considerably longer than the males. Proboscis knob-like, with 3 transverse rows of 6 hooks each. Neck distinct, conical, broader at base. Longitudinal lacunar vessels distinct, extending upto the posterior tip of the body. Hypodermic nuclei elliptical.

Male : Body thin, filiform, anteriorl attenuated, venrally inclined, 12.01 x 0.4 mm with the diameter of the trunk being uniform. Proboscis 0.15 x 0. 14 mm. Hi = 100 u, Ri = 45 u; Hii=20u, Rii = 10 u ; Hiii = 18 u, Riii = 10 u. Neck 0.17 x 0.1 mm. Lemnisci elongate tubular, equal, each about 1.25 mm long.

Testes elongate claviform, pre-equatorial, sub-equal, the anterior one 1.6 x 0.1 mm, the posterior 2.6 x 0.1 mm. Cement gland elongate, syncytial, anteriorly attenuated, posteriorly rounded and indented, 1.2 mm long, 0.2 mm wide at maximum posteriorly. Cement reservoir oval, 0.28 x 0.25 mm, with paired efferent ducts, each 0.7 mm long. Saefftige's pouch oval, 0.6 mm in length including its duct. Bursa short, dome-shaped, 0.2 x 0.2 mm dorsally ; total length of vestibule 0.75 mm.

Female : Fairly long, slender, filiform ; 16.0 - 38.0 x 0.5 - 0.9 mm. Anterior extremity narrow, attenuated, ventrally bent, posterior extremity bulbose, 0.8 - 1.5 mm in width at the level of the uterus. Shape and size of the proboscis, proboscis hooks, proboscis receptacle and lemnisci same as in males. Female genital tract within the swollen proximal bulbose region. Uterine bell dextral, distally wide, proximally narrow and partially recumbent, 0.3 x 0.25 mm. Uterus long, tubular, 0.4 x 0.1 mm. Female genital pore sub-terminal, 0.6 mm anterior to the base of the posterior bulb. Vagina 0.2 mm long, surrounded by thick muscular walls with proximal sphincter modified and incorporated therein. Distal sphincter 0.05 mm in diameter. Eggs 45 - 50 x 30 u each.

Type host : Otolithoides brunneus CUVIER - (Sparidae)
Type locality : Bombay, India.
Holotype male, allotype female and paratypes deposited in Zoological Museum, AMU, Aligarh.

Neoechinorhynchus mollissimus markedly differs from all the other known Indian species of the genus Neoechinorhynchus recorded from marine hosts. It, however, closely resembles N. johnii YAMAGUTI, 1939 in the size of the females but differs from the latter in the shape and size of the proboscis hooks and of the neck; the latter being short and truncated the former and comparatively longer, cylindrical and of uniform width in the latter. The two species also differ from each other in the organization of the female terminalia. The vaginal terminus of N. johnii is modified into a large mushroom-shaped musculo-fibrous accessory organ which the females of N. mollissimus do not possess. Further, the males of N. johnii are not known but it appears that the two species are closely related and perhaps had common marine parasite-ancestor.

(iii) Neoechinorhynchus paratylosuri n. sp.

(Pl. VI, Fig. 58-62)

Description based on 12 specimens (2 mature and 3 young males and 7 young females) with characters of the genus. Body long, cylindrical, pseudosegmented and robust in mature males. Posterior extremity of males usually curved. Proboscis short, knob-like, armed with 3 transverse rows of 6 hooks each. Neck obliterated. Lemnisci typically dissimilar in size , 1:3. Testes and cement glands excessively elongated; the latter usually 3-lobed in fully grown males.Bursa large, wider than long, shallow. Penis large, conical, projecting out in prolapsed bursal condition. Female genital pore postero-terminal, transversely slit, surrounded by an accessory musculo-glandular cushion.

Males: 27.0 - 37.00 x 0.8 - 1.2 mm. Proboscis 0.10 x 0. 15 mm. Hi = 55 u, Ri = 30 u ; Hii = 25 u, Rii = 12-15 u; Hiii = 20 u , Riii = 10 u. Proboscis receptacle saccular with distinct oblique and meridional musculature, 0.35 - 0.45 x 0.13 - 0.15 mm. Cerebral ganglion pyriform, basal, 0.09 x 0.04 mm. Lemnisci grossly unequal; the longer one fusiform, 3.0 - 3.25 x 0.1 mm, with two elongate filamentous nuclei; the shorter one also fusiform or digitiform (in young males), 0.9 - 1.0 x 0.09 mm , with single filamentous nucleu about 40 u long. Hypodermic nuclei elliptical, 5 dorsal, 1 ventral, each about 30 u long.

Testes excessively long and claviform in mature specimens, elongate elliptical in young males, post-equatorial, directly tandem, slightly sub-equal; anterior testis 3.7 - 7.55 x 0.3-0.4 mm; posterior one 2.8 - 7.5 x 0.3 - 0.4 mm. Cement gland long, saccate-constricted, in mature specimens, into three lobes, 1.5 - 6.5 mm long, 0.2 - 0.55 mm wide in the middle. Cement reservoir large, usually constricted in the middle in mature individuals, 0.4 - 1.5 x 0.25 mm. Seminal vesicle 0.25   0.65 x 0.15 - 0.25 mm. Saefftigen's pouch large, pyriform, 0.3 x 0.2 mm. Bursa large, with thick muscular bursal cap, vestibule peolapsed in robust specimens, 0.25 x 0.6 mm. Penis relatively long, truncate conical, 0.1 mm long, 0.15 mm wide at base.

Females : more slender than the males. Body tapering at the extremities, 30.0 35 x 0.2 mm. Presomal structures similar in shape and size to those of males. Uterine bell broad, U-shaped, 0.15 x 0.09 mm. Uterus elongate, tubular, 0.35 x 0.07 mm. Vaginal sphincters tandem, 60 u and 45 u in diameter respectively. Vagina 0.3 mm long. Female genital pore postero-terminal with a peri-vulvuler cushion 0.6 mm across. Eggs elliptical, each 45 x 30 u.

Type host : *Tylosurus strongylurus* VAN HASSELT - (Belonidae).
Other hosts : *Pseudosciaena diacantha* (GUNTHER) - (Sciaenidae).
Pristipoma hasta (BLOCH) - (Pristipomatidae).
Polynemus heptadactylus CUV. & VAL.* - (Polynemidae)
Lutjanus johni (BLOCH) - (Lutjanidae).**
Location : Stomach (robust male specimens), intestine.
Type locality : Karwar , W India.
Other localities: Calicut, (*) , Cochin (**).
Holotype male, Allotype female and various paratypes deposited in Zoological Museum, AMU, Aligarh.

In having an elongate robust trunk, dissimilar lemnisci, long claviform testes and elongated saccate cement gland with large elliptical various nuclei, *Neoechinorhynchus paratylosuri*, the new species described in this study, comes closer to *N. tylosuri* YAMAGUTI, 1939 from Japan but differs from the latter in the size of the proboscis hooks, proportionate length of the lemnisci and in the post-equatorial location of the testes which are, otherwise, located in the anterior 1/3 of the trunk in the Japanese congener.

The species is named *N. paratylosuri* on account of its similarity with *Neoechinorhynchus tylosuri* YAMAGUTI, 1939 from Japan.

* * * * *

(iv) *Neoechinorhynchus nigeriensis* n. sp.

(Pl. V., Fig. 46-48)

The material pertianing to the present species was collected by Dr. Ather H. Siddiqi at Lagos, Nigeria, during the summer, 1965.

Description based on two male specimens with characters of the genus. Body elongate, cylindroid, tapering anteriorly. Holotype male 9.6 x 0.92 mm, paratype male 12.0 x 0.5 mm. Proboscis oval, 0.18 x 0.09 mm, armed with 3 transverse rows of 6 hooks each; Hi = 60 u, Ri = 40 u; Hii = 25 u, Rii = 15 u ; Hiii = 20 u, Riii = 10 u. Neck distinct, truncate conical, 120 u long, 130 u wide at apex, 250 u wide at base. Proboscis receptacle sub-cylindrical, ventrally curved, 0. 35 x 0.22 mm. Cerebral ganglion oval, anterior to the base of the receptacle. Lemnisci tubular, equal, each 1.4 x 0.04 mm.

Testes oval, tandem post-equatorial; anterior testis 1.0 mm and posterior testis 1.2 mm long, each 0.5 mm wide in the middle. Cement gland oblong, posteriorly attenuated, 1.6 x 0.45 mm. Cement reservoir pyriform, 0. 45 x 0.28 mm. Seminal vesicle 0.45 long, with ducts 0.6 mm long each. Saefftigen's pouch ventral, 0.5 mm long. Everted bursa fan-shaped, 0.3 mm wide. Total length of vestibule 0.6 mm.

Female : not known.

Type host : <u>Galeoides decadactylus</u> (BLOCH) - Solenymidae.

Type locality : Lagos, Nigeria.

Type specimens (Holotype male and 1 paratype) deposited in Zoological Museum, AMU, Aligarh.

The neoacanthocephalan fauna of Nigeria and the central African region is little known. This is probably the first record of the occurrence of a <u>Neoechinorhynchus</u> species from Nigeria. Previously only one neoechinorhynchid species, <u>Hexaspiron nigericum</u> was described by GOLVAN (1956) from this region. Recently , TRONCY - (1971) has described <u>N. africanus</u> from a fresh-water fish of the river Chari in Chad. Consequently, among the African neoechinorhynchs <u>N. nigeriensis</u> , the new species, can be compared from <u>N. africanus</u> TRONCY, 1971 from which it can be distinguished on the basis of the shape of the body, in size of the proboscis hooks which are larger in the former, in the location of testes in males which are post-equatorial in the former and markedly pre-equatorial, almost adjacent to the base of the proboscis receptacle in the latter, and also in the extent of the lemnisci. These do not quite extend upto the testes in N. nigeriensis whereas in N. africanus the lemnisci extend well beyond the posterior testis. Secondly the former species occurs in fresh-water hosts and the latter in marine hosts.

In its general appearance, N. nigeriensis, however, resembles Neoechinorhynchus coiliae YAMAGUTI, 1939, also a marine parasite species but is readily distinguishable from the latter in the shape and size of proboscis hooks. In N. coiliae the apical and second-circle hooks (Hi & Hii) areo of the same size (45-50 u) whereas in N. nigeriensis the hooks of succeeding circles proportinately decrease in size antero-posteriorly. Both these species are,however, from marine hosts though from remarkably distant zoo-geographical realms ; oceans apart.

(v) Neoechinorhynchus minutus n. sp.

(Pl. VI, Fig. 49-50)

The Caracas Collection No. 1.611 from Mugil cephalus L., contained, besides numerous specimens of Floridosentis mugilis (MACHADO FILHO, 1951) (reported latter in the present study), two specimens of what represents a new species in the genus Neoechinorhynchus described here as N. minutus sp. nov. The exact number of host specimens from which the two parasite species were collected is not mentioned in the Caracas records.

Male : Body small, fusiform, tapering at extremities ; 1.8 - 2.0 x 0.25 mm, with maximum width at the level of the anterior testis in mid body region. Proboscis short, cylindrical, 45 x 25 u ;

beset with 3 circles of 6 hooks each ; Hi = 20 u, Ri = 10 u ; Hii = 12 u, Rii = 8 u ; Hiii = 10 u, Riii = 5 u. Neck short, distinct, truncate conical, 20 u long, 35 u wide at base. Proboscis receptacle 0.18 x 0.05 mm. Lemnisci elongate, tubular, each 0.45 mm long.

Testes relatively large, oval, post-equatorial, sub-equal ; anterior testis 0.32 x 0.17 mm, posterior testis 0.25 x 0.17 mm. Cement gland spherical, 0. 08 mm across. Cement reservoir pyriform, 0.05 x 0.05 mm. Seminal vesicle 0.22 mm. Saefftigen's pouch 0. 25 mm in length. Bursa 0. 15 mm long, 0.07 mm wide anteriorly.

Female : not known.

Type host : Mugil cephalus LINNEUS. - (Mugildae)

Type locality : Puerto Tuy., Miranda , Venezuela.
Holotype male No. 1.611/5 and paratype (No. 1.611) to be deposited in Museum National Historia Naturelle, La Salle, Caracas, Venezuela. Accession No. to be determined later.

The genus Neoechinorhynchus is represented by seven of its species in the Neotropical realm. These include N. variabilis (DIESING, 1851) , N. macronucleatus MACHADO FILHO, 1954, N. buttnerae GOLVAN, 1956, N. spectabilis MACHADO FILHO, 1959 , N. australis VAN CLEAVE, 1931 (vide HARTWICH, 1956), N. paraguaensis MACHADO FILHO, 1959 and N. prochilodorum NICKOL & THATCHER, 1971. The first four of these are reported from Brazil, the next two from Paraguay and the last one from Colombia. None has, however, been recorded from Venezuela and _N. minutus_ sp. nov. is thus the first record of its kind from that Country.

Of the seven aforementioned species, two have been assigned to two different genera; _N. variabilis_ to _Gracilisentis_ by PETROCHENKO (1956) and _N. spectabilis_ to _Gorytocephalus_ by NICKOL & THATCHER (1971). The transfer of the former has, however, been doubted by some workers since PETROCHENKO (1956) has overlooked the account given by TRAVASSOS, ARTIGAS & PEREIRA (1928), though brief that too happens to be.

As has already been stated above, _N. minutus_ is the first _Neoechinorhynchus_ species being reported from Venezuela. It markedly differs from its remaining Neotropical congeners in the minuteness of size and also in the size of its proboscis and hooks; both being smallest among these all. It, however, resembles _N. prochilodorum_ in some respects but can be distinguished from the latter in having relatively much smaller presoma, and also in the extent of the lemnisci which are comparatively longer, though slightly subequal in the Colombian species in which the longer one extends past the anterior testis in males whereas in _N. minutus_ the lemnisci are equal, shorter and do not extend beyond the anterior 1/3 of the body length.

Key to the Neotropical species of *Neoechinorhynchus*

(1) a - Body elongate, cylindrical, more than 20 mm long, Hi = 135 u .... *N. buttnerae*.

b - Body short, plump or fusiform, not exceeding 10 mm in length, Hi = 100 u or less .... (2)

(2) a - Lemnisci unequal .... (3)

b - Lemnisci equal .... (4)

(3) a - Hi upto 90 u in length .... *N. australis*.

b - Hi upto 60 u in length .... *N. prochilodorum*.

(4) a - Body fusiform, females obese, Hi = 100 u, lemnisci short, digitiform .... *N. paraguensis*.

b - Body elongate, slender, lemnisci tubular, Hi = 100 u or less .... (5)

(5) a - Trunk 5 - 7 mm long, Hi = 50 u, Hii & Hiii equal .... *N. macronucleatus*.

b - Trunk upto 2 mm in length, Hi = 20 u, Hii & Hiii dissimilar .... *N. minutus*.

Subfamily Floridosentinae GOLVAN, 1959

1. Genus *Floridosentis* WARD, 1953.

Generic diagnosis : Neoechinorhynchidae of medium size. Trunk long, slender, tapering at extremities. Proboscis cylindrical or ellipsoidal elongate; armed with 8 - 10 diagonal rows of 7-8 hooks each, the anterior 3 or 4 being larger, thence diminishing gradually in length. Neck short or long. Lemnisci half as long as the trunk. Proboscis receptacle subcylindrical with ganglion usually in the middle. Testes oval, tandem, post-equatorial. Cement gland long, saccate, syncytial, with larger nuclei. Cement reservoir with paired efferent ducts. Parasites of marine fishes. Distribution restricted to the New World.

Type species : *Floridosentis mugilis* (MACHADO FILHO, 1951)

* * * * * * * * * * * *

(1) *Floridosentis mugilis* (MACHADO FILHO, 1951).

Syn.- *Floridosentis elongatus* WARD, 1953 : fide BULLOCK (1962.

Material : Caracas Collection No: 3.607, 3.640,
6 males, 11 females

Host : *Mugil cephalus* LINNEUS - (Mugilidae),
Locality : Puerto Tuy, Miranda., Venezuela.

Originally described as *Atactorhynchus mugilis* by MACHADO - FILHO (1951), this species was relegated to the genus *Floridosentis* WARD, 1953 by BULLOCK (1962) who not only renamed it *F. mugilis* but also designated it as the type of Ward's genus.

This species was first described from Mugil platanus of Rio de Janeiro, Brazil and later as Floridosentis elongatus by WARD (1953) from Mugil cephalus in Florida. The present report is the first distributional record of this parasite in Venezuela. The fish host not only harboured F. mugilis but also yielded the other neoechinorhynchid species, Neoechinorhynchus minutus, earlier described as a new species in this study.

The specimens (F. mugilis in Caracas Collection) entirely conform with the original description of Floridosentis elongatus WARD (1953).

(ii) Floridosentis longinuchalis n. sp.

(Pl. VIII, Fig. 63-67)

Material : Caracas Collection No : 2.215 & 2.217 from Puerto Fermin, and No : 1.611 from Punta Piedras, Venezuela.

Description based on 3 males and 17 females with characters of the genus. Body elongate, cylindrical, tapering at extremitities. Proboscis short, cylindrical, rounded apically. Proboscis hooks in 10 diagonal rows of 6.8 hooks each, I - III of each row being larger, thence gradually diminishing in size. Neck distinct, comparatively longer, truncated anteriorly and wider posteriorly with maximum width at the base. Proboscis receptacle large, inserted half way up in the presoma. Lemnisci long, slender, sub-equal, the longer lemniscus reaching the gonads in males and 1/3 the trunk length in females. Testes elongate oval, directly tandem, pre-equatorial. Cement gland separated from the posterior testis by a short distant gap.

Males : 1.0 - 8.5 x 0.7 - 0.9 mm. Proboscis 0.4 x 0.15 mm. I and II hooks of each row larger, each about 60 u long with roots upto 30 u in length. III and IV hooks of each row 40 u long, roots upto 30 u each; last 3 of each row small, arcuate, each about 12 u long, roots 10 u each. Neck long, 0.45 x 0.13 mm distally, 0.35 mm wide proximally. Proboscis receptacle 0.8- 1.2 x 0.25 mm. Short lemniscus 2.0 mm, longer one 2.9 - 3.3 mm in length, 0.09 mm in width.

Testes elongate oval, tandem, each 0.5 x 0.3 mm. Cement gland posteriorly notched, 1.0 x 0.17 mm, a short distance away from the posterior testis. Cement reservoir 0.15 x 0.13 mm. Seminal vesicle 0.35 mm long. Saefftigen's pouch reniform, ventro-dextral to the seminal vesicle, 0.3 x 0.09 mm. Bursa 0. 65 mm long.

Females : Similar to males in shape and size except that the neck is slightly longer. Uterine bell fusiform, 0.22 x 0. 15 mm. Uterus olviform, 0.35 x 0.15 mm. Vagina 0.07 - 0.09 mm long. Vaginal bulb 0.075 mm across. Female genital pore ventro-terminal. Eggs elliptical or elongate oval, 30 x 10 u each.

Type host : Pomatomus saltatrix (L). - (Pomatomidae).
Other hosts : Caranx ruber (BLOCH) - Carangidae,
Haemulon sp., - Pomadasyidae.

Type locality : Puerto Fermin, Venezuela.

Other locality : Punta Piedras, Venezuela.

Holotype male, Allotype female and paratypes to be deposited in Museum Nacional Historia Naturelle, La Salle, Caracas, Venezuela, under Accession No: 2.215/1 (Holotype), 1.611/4 (Allotype). Paratypes in Zoological Mueum, AMU, Aligarh.

Floridosentis longinuchalis n. sp. is readily distinguishable from the only other congener, *F. mugilis* (MACHADO FILHO,1951) in having a distinctly longer neck, which is, otherwise, obliterated in the nominal type, and also in the number and size of proboscis hooks.

Key to species of the genus *Floridosentis* WARD, 1953.

(1) a - Proboscis cylindrical, neck obliterated, proboscis hooks in 6-8 diagonal rows .... *F. mugilis*.

b - Proboscis claviform, neck long, broader at base, proboscis hooks in 10 diagonal rows .... *F. longinuchalis*.

Family Tenuisentidae VAN CLEAVE, 1936

1. Genus *Tanaorhamphus* WARD, 1918.

Generic diagnosis : Tenuisentidae of medium or small size. Body elongate, fusiform, tapering at extremities. Proboscis long, cylindrical, beset with 16-20 longitudinal rows of hooks disposed in linear pattern. Proboscis receptacle single layered with meridional musculature. Neck short. Cerebral ganglion basal. Lemnisci long, tubular. Testes tandem, post-equatorial. Cement gland single, syncytial. Female genital pore ventro-terminal. Eggs elongate,oval. Parasites of eels. Distribution restricted to North America.

Type species : *Tanaorhamphus longirostris* (VAN CLEAVE,1913).

The genus *Tanaorhamphus* includes the two species, the type, *T. longirostris* (VAN CLEAVE, 1913) WARD, 1918 and *T. ambiguus* VAN CLEAVE, 1921 but the latter is inadequately described. VAN CLEAVE (1921) had based the original description on a single female specimen, originally collected by Albert Hassall on 30 May, 1891 at Baltimore, Md. and deposited in USNM Helminthological Collection, Catalogue No: 3071 whence it was made available to Van Cleave. Later on two more specimens, collected by Edwin Linton were added to that collection but both, which included a male specimen also, were very poorly preserved and could not be reckoned by Van Cleave as adequute for study. Consequently he based the description on the single female. (Hassall material) which he designated as the 'type female'. No further description or account of this species has since then appeared and a redescription is warranted.

Through the courtesy of Dr W.L. Bullock, Durham, N.H. fresh material pertaining to this species has been made available and that has enabled the present author to furnish a redescription of T. ambiguus. One of these specimens, the male, heretofore undescribed, is being selected as lectotype and the accompanying female as paralectotype since Van Cleave did not designate any type at the time of original description. The two specimens thus selected and designated will be deposited in the USNM Helminthological collection in the course of time.

(1) Tanarhamphus ambiguus VAN CLEAVE, 1921

(Pl. VIII, Fig. 68-69)

Male : With characters of the genus. Body elongate, cylindrical, broader anteriorly and tapering posteriorly; 8.0 x 0.9 mm in maximum width at level of the proboscis receptacle. Proboscis long, cylindrical, 0.7 x 0.2 mm, armed with 20 longitudinal rows of 16 hooks each; anterior hooks (I-VIII of each longitudinal row) longer, each about 45 u long, remaining 8 of each row gradually decreasing in size for 30 to 20 u each. Roots of hooks well developed; upto 30 u each in the former, 10 - 15 u each in the latter. Neck short, attenuated. Proboscis receptacle elongate, U-shaped, 0.9 x 0.3 mm with ganglion at its base. Lemnisci long, fusiform, one of them uni-nucleate, the other binucleate (contrary to Van Cleave's report that one of the lemniscus possesses 3 oval nuclei ; it might have been teratological instead); each about 1.5 mm long, 0.05 mm wide.

Testes post-equatorial, tandem, elongate oval, each 0.55 x 0.25 mm. Cement gland saccular, elongate, 0.8 x 0.25 mm. Cement reservoir spherical, 0.25 mm across. Seminal vesicle fusiform, 0.25 mm in length. Saefftigen's pouch pyriform, ventro-lateral to seminal vesicle: 0.3 x 0.15 mm. Bursa 0.3 mm wide. Bursal cap muscularised with large median papillaeform penis.

Female : Body elongate, fusiform, 1.0 mm long, 0.65 mm wide anteriorly, 0.25 mm posteriorly. Shape and size of proboscis, its hooks, proboscis receptacle and lemnisci same as in male. Uterine bell deep cup-shaped, 1.5 x 0.5 mm. Selective apparatus floccular. Uterus elongate, tubular, 2.5 x 0.75 mm. Vaginal sphincters tandem, each about 50 u in diameter. Female genital pore ventro-terminal. Eggs elliptical ; each 40 x 15 u.

Type host : _Anguilla chrysypa_ RAFINESQUE, - Anguillidae.
New host : _Anguilla rostrata_ (LESUEUR), - Anguillidae.
Type locality: Baltimore, Md.
Lectotype male and paralectotype female to be deposited in USNM Helminthological Collection.

Key to species of the genus Tanaorhamphus

(1) a - Proboscis hooks in 16 longitudinal rows of 10 hooks each. Lemnisci half as long as the trunk .... _T. longirostris_ .

b - Proboscis hooks in 20 longitudinal rows of 16 hooks each. Lemnisci 1/4 of the body length .... _T. ambiguus_ .

II. Order Palaeacanthocephala MEYER, 1931

Family Acanthodeltidae n. fam.

Palaeacanthocephala of medium size. Body elongate, slender, cylindrical. Proboscis globose, armed with few oblique rows of large stout hooks, the basals largest, tusk-like. Proboscis receptacle U-shaped, double walled with cerebral ganglion at its base. Testes oval, tandem, pre-equatorial. Cement glands 4, elongate, tubular. Fore-trunk spinose. Parasites of Neotropical fishes. Distribution restricted to Neotropical region.

Type genus : Acanthodelta DIAZ-UNGRIA & GRACIA RODRIGO,1958 - type by original designation.

1. Genus Acanthodelta DIAZ-UNGRIA & GRACIA RODRIGO,1958, emend.

Synonym : Deltania DIAZ-UNGRIA & GRACIA RODRIGO,1957.

Generic diagnosis : With characters of the family Acanthodeltidae. Body elongate, cylindrical. Fore-trunk beset with minute cuticular spines disposed in few circular rows. Proboscis globular, armed with 8 diagonal rows of large hooks. Anterior hooks acutely bent, posterior basal hooks largest, tusk-like. Neck short, distinct. Lemnisci long, tubular. Proboscis receptacle sub-cylindrical, inserted in theppresoma at the level of the posterior hooks. Testes oval, tandem, pre-equatorial, nearer anterior extremity. Cement glands 4, elongate, tubular, occupying 2/3 of total trunk-length.

Type species : Acanthodelta scorzai (DIAZ-UNGRIA & GRACIA - RODRIGO,1957) - type by original designation.

The genus Acanthodelta was originally included under the family Quadrigyridae by DIAZ-UNGRIA & GRACIA RODRIGO (1957) and (1958) since these authors had presumed the proboscis receptacle single layered and the cement glands single and syncytial in the type species, Acanthodelta scorzai (DIAZ-UNGRIA & GRACIA RODRIGO, 1957). A re-examination of the holotype male (Caracas Museum No: 537), however, indicates that both these characters are contrary to original description and need a rectification. The Proboscis receptacle id distinctly double-layered and the cement glands comprise 4 discrete tubular masses. Consequently, the genus is untenable within Quadrigyridae (Order Eoacanthocephala) and is, therefore, being assigned to the new family Acanthodeltidae under the Order Palaeacanthocephala.

The genus was originally named as Deltania by DIAZ-UNGRIA & GRACIA RODRIGO (1957) but was renamed Acanthodelta by these authors, DIAZ-UNGRIA & GRACIA RODRIGO (1958) since the former name was preoccupied by a flagellate genus.

(i) Acanthodelta scorzai (D-U & GR. RODRIGO,1957)D-U & GR.1958

Synonym : Deltania scorzai DIZ-UNGRIA & GRACIA RODRIGO,1957.

(Pl. IX, Fig. 10-73)

Material : Holotype male, Catalogue No: 537 from Museo Nacional de Historia Naturelle, Caracas,Venezuela through Carlos Diaz-Ungria.

Description and redescription based on a single male specimen with characters of the genus as emended above.

Family Rhadinorhynchidae TRAVASSOS, 1923

Subfamily Rhadinorhynchinae LUHE, 1912

1. Genus Nipporhynchus CHANDLER, 1934.

Synonyms : (= Rhadinorhynchus LUHE, 1911, (partim)
= Raorhynchus TRIPATHI, 1959 .- new synonymy.

Generic diagnosis : Rhadinorhynchidae, Rhadinorhynchinae. Body elongate, slender, medium sized. Fore-trunk beset with minute spines uniformly distributed more on the ventral than on the dorsal side., often in two fields narrowly interrupted from each other. Proboscis elongate, cylindrical or claviform, with a basal corona of large arcuate hooks, remaining hooks in numerous longitudinal rows. Dorso-ventral differentiation in the shape and size of the hooks distinct ; the ventrals more stout and arcuate than the dorsals in each longitudinal row. Lenisci tubular, equal to, or shorter than the receptacle. Cement glands in two tandem pairs, the poserior pair often half as long as the anterior one. Female genital tract long, tubular. Vagina with two tandem sphincters. Eggs elliptical, with distinct polar bulbs in the thicker middle shell. Parasites of marine fishes only.

Type species : Nipporhynchus katsuwonis (HARADA, 1928) CHANDLER, 1934.

CHANDLER (1934) erected the genus Nipporhynchus to accommodate certain rhadinorhynchidspecies commensurate with the characters cited above. VAN CLEAVE (1940), VAN CLEAVE & LINCICOME (1940), WARD (1951), PETROCHENKO (1956) and YAMAGUTI (1963) have all accepted this proposition but GOLVAN (1969) has recently disagreed with this view since he has considered *Nipporhynchus* a junior synonym of the genus *Rhadinorhynchus*. This is perhaps in consonance with the decision of CABLE & LINDEROTH (1963) who have expresse expressed similar views earlier. However, a steady increase in the number of the known species under these two genera now warrants the resurrection of the genus *Nipporhynchus* as it will help in the rationalization of the taxonomy of the Rhadinorhynchinae better as it is already in a state of confusion. The reasons for this decision and the criteria for the differentiation of the two reciprocal genera, *Rhadinorhynchus* and *Nipporhynchus* , s.s, are discussed later (Chapter V).

The genus *Raorhynchus* TRIPATHI, 1959 is also here considered a synonym of the genus *Nipporhynchus* (= *Rhadinorhynchus* sensu GOLVAÑ, 1969, in part). TRIPATHI (1959) had characterised the genus *Raorhynchus* by the presence of only two cement glands in the males of the nominal type, but a re-examination of the holotype male of *R. polynemi* TRIPATHI, 1959 (CIFRI, Barraspore Collection) and numerous specimens obtained from *Polynemus sextarius* (type host) and some other polynemid fishes of Indian region has indicated the presence of two partly overlapping pairs of elongated claviform cement glands in the males of *R. polynemi*. The holotype male was an immature specimen and the two pairs of cement glands were so compressed thatb their identity probably bacame obscure and led TRIPATHI (1959) believe they were a single pair. In having two superimposed pairs of cement glands, *Raorhynchus polynemi* conforms with the concept of genus *Nipporhynchus* and thus renders *Raorhynchus* its junior synonym.

(i) *Nipporhynchus polynemi* (TRIPATHI, 1959) n. comb.

Syn: = *Raorhynchus polynemi* TRIPATHI, 1959 .- new synonym

= *Rhadinorhynchus polynemi* GUPTA & LATA, 1967 .- new syn.

Hosts : *Polydactylus sextarius* (BLOCH), type host, (Polynemidae), *Polynemus heptadactylus* CUVIER - (Polynemidae), type host of *Rhadinorhynchus polynemi* GUPTA & LATA, 1967 (sic), *Polynemus plebius* (BLEEKER) (Polynemidae), new host, *Pristipoma maculata* GUNTHER - (Pristipomatidae), new host.

Localities : Puri, Orissa (type locality) ,

Cochin, Calicut, Karwar, Madras : new locality records.

Nipporhynchus polynemi (TRIPATHI, 1959) was originally recovered from the type host, *Polydactylus sextarius* at Puri. GUPTA & LATA (1967) described the other species, *Rhadinorhynchus - polynemi* from *Polynemus heptadactylus* but did not mention the type locality for their species. Another closely resembling form, *Rhadinorhynchus asturi* GUPTA & LATA, 1967 was described by these authors from an eagle, *Astur badius* , with Hoshiarpur, Punjab as its type locality. In all possibilities these two species, i.e. *Rhadinorhynchus polynemi* and *R. asturi* are identical and both are conspecific with *Raorhynchus polynemi* TRIPATHI, here considered a synonym of *Nipporhynchus polynemi* (TRIPATHI). There appears no significant difference between the description and measurements of *N. polynemi* and ' *R. polynemi*, GUPTA & LATA and the latter becomes a direct junior synonym of the former. The description of the other species, *R. asturi* is inconclusive but its occurrence in the eagle is incredible. Re-examination of this species would perhaps lend support in regarding it a synonym of *N. polynemi* too.

(ii) Hipporhynchus atheri n. sp.

(Pl. IX. Fig. 74-82)

Material pertaining to this species comprising 5 males and 2 females was collected by Dr. Ather H. Siddiqi at Lagos (Nigeria) during the summer of 1965.

Body slender, filiform with marked sexual dimorphism, females three times longer than males. Proboscis elongate, claviform, usually bent ventrally at an acute angle. Proboscis hooks in 12 longitudinal rows of 30 - 36 hooks each with marked dorso-ventral differentiation in shape and size. Basal corona of large spiniform arcuate hooks radiating peripherally. Neck short, distinct, truncated. Trunk spines minute, extending upto the level of testes in males and upto the mid-body region or slightly beyond that in females. Spines more extensive dorsally than ventrally in males. Proboscis receptacle elongate, U-shaped with ganglion in the mid-receptacle region. Lemnisci elongate, spatulate, half as long as the proboscis receptacle.

Male : Body 11.8 - 12.5 x 0.5 mm. Proboscis 1.2 x 0.12 mm. Dorsal hooks larger, spiniform, with attenuated roots, obtuse, anterior 18 - 24 hooks large, each 50 - 60 u long, remaining hooks gradually becoming short and recurved, though less so, decreasing in length from 25 to 15 u each. Corona of basal spines radiated, each hook about 60 u long. Ventral hooks short, arcuate, broader at base, partly ensheathed: apicals 30 u long, next 6 hooks 45 u each, followed by next 6 hooks, each 60 u long, succeeding hooks smaller and rose-thorn shaped, decreasing from 20 to 10 u in length. Neck short, conical, 0.3 x 0.35 mm. Trunk spines numerous ventrally than dorsally in anterior half, the converse posteriorly, ventral spines larger than dorsals, 10 - 12 each respectively. Proboscis receptacle elongate, U-shaped, 3.5 x 0.25 mm, inserted at the base of the corona radiata. Lemnisci short, spatulate, each 1.8 x 0.08 mm.

Testes elongate oval, tandem, contiguous, post-equatorial, 1.0 and 1.25 x 0.3 mm respectively. Cement glands in two subequal superimposed pairs, anterior pair immediately behind the posterior testis, posterior ventral pair half as long as the antero-dorsal pair; total length of cement glands about 2.65 mm, each about 0.2 mm wide anteriorly. Seminal vesicle 0.7 x 0.1 mm. Bursa deep cylindrical, bursal cap with muscular modifications, 0.35 x 0.2 mm. Vestibule 0.65 mm. Bursal rays 12-16, short, digitiform.

Female : Slender, giliform, 24.0 - 30 x 0.8 mm with uniform width of the trunk. Proboscis slightly longer than in males, claviform or cylindrical, 1.35 x 0.12 mm. Shape, size and arrangement of proboscis hooks and trunk spines same as in males. Proboscis receptacle3.7 x 0.15 mm. Trunk spines extending beyond the midbody region. Genital tract long, tubular. Uterine bell 0.40x0.1 mm. Uterus long, tubular, 4.0 x 0.1 mm, proximally distended. Vaginal sphincter single, 0. 05 mm across. Vaginal funnel 0.1 mm long. Vaginal opening terminal. Eggs spindle-shaped with long polar projections, each 70 x 20 u.

Type host : Galeoides decadactylus (BLOCH) - Polynemidae.

Type locality : Lagos, Nigeria.

Holotype male and allotype female deposited in Zoological Museum, AMU, Aligarh.

Nipporhynchus atheri n. sp. comes closer to N. africanus GOLVAN et al, 1964 from Sette-Kama, Gabon, but differs from the latter in the number and shape of proboscis hooks and also in the extent of trunk spines which extend upto the testicular field or mid-body region in the former whereas in the latter species they are confined anteriorly upto the posterior limit of the lemnisci which are half as long as the proboscis receptacle. Further, the ventral hooks of N. atheri are more stout, broader and recurved than those of N. africanus. On the basis of the nature of trunk spines the present species can also be differentiated from another closely related African congener, Nipporhynchus cadenati GOLVAN & HOUIN, 1964 which has been recorded from numerous marine fishes of Goree, Dakar, Senegal.

Nipporhynchus atheri n. sp. is named after Dr Ather H. - Siddiqi, Department of Zoology, AMU, Aligarh.

(iii) *Nipporhynchus cadenati* GOLVAN & HOUIN, 1964

Syn. = *Rhadinorhynchus cadenati* GOLVAN & HOUIN, 1964, hoc loco.

Material : 11 specimens : 4 males and 7 females, collected by Dr. Ather H. Siddiqi on 13. 12. 1965.

Host : *Galeoides decadactylus* (BLOCH) - Polynemidae.
Locality Lagos, Nigeria.

This is a new record of the occurrence of *N. cadenati* GOLVAN & HOUIN, 1964 in Nigeria. Originally it was described from various marine fishes at Goree, Senegal. This report extends its range of geographical distribution farther south-east to Nigerian coast at Lagos.

The specimens conform with the original description in all essential details. The assignment of this species to the genus *Rhadinorhynchus* (fide GOLVAN, 1969) is, however, untenable since its trunk-spination is more akin with the pattern in the species of the genus *Nipporhynchus* than in *Rhadinorhynchus*.

Key to species of the genus *Nipporhynchus*.

(1) a - Proboscis hooks in 22-24 longitudinal rows of 40 each .... *N. katsuwonis*

b - Proboscis hooks in 10-16 longitudinal rows with 24-36 hooks each .... (2)

(2) a - Lemnisci as long as the receptacle, testes pre- or post-equatorial .... (3)

b - Lemnisci half as long as the receptacle, testes post-equatorial........................... (4)

(3) a - 12 longitudinal rows of 24 hooks each, testes pre-equatorial .... *N. polynemi*.

b - 16 longitudinal rows of 25 hooks each, testes post-equatorial .... *N. cadenati*.

(4) a - Proboscis hooks in 10 longitudinal rows, all hooks of uniform shape, no dorso-ventral differentiation, proboscis receptacle extending upto anterior testis .... *N. carangis*.

b - Proboscis hooks in 12 - 14 longitudinal rows, dorso-ventral differentiation in shape and size of hooks distinct, proboscis receptcale not extending upto testes .... (5)

(5) a - Trunk spines confined to posterior limits of the lemnisci .... *N. africanus*.

b - Trunk spines more extensive, extending upto the level of testes in males and to mid-body region in females .... *N. atheri*.

Family Serrasentidae (PETROCHENKO,1956) n. grad.

Body ornate, elongate with transverse sagittate combs on the ventral surface, 8-10 circular rows of cuticular spines anteriorly, immediately behind the neck. Proboscis short, claviform with numerous longitudinal rows of hooks. Four elongate, tubular cement glands. Parasites of marine fishes.

Type genus : Serrasentis VAN CLEAVE, 1923.

1. Genus Serrasentis VAN CLEAVE, 1923

Generic diagnosis : with characters of the family as above. Proboscis with 20-24 longitudinal rows of stout hooks of uniform shape and size. Neck distinct, conical. Fore-trunk with 8-10 rows of cuticular spines, followed by 20-40 sagittate combs on the ventral surface extending upto the posterior half, or 1/3 (depending on the age of the worm) of the body. Lemnisci long, tubular, extending far beyond the proboscis receptacle. Testes oval, contiguous (in younger forms), or distantly tandem, wider apart (in mature and older forms). Cement glands long, tubular, 4. Bursa with an accessory dorsal gland.

Type species : Serrasentis socialis (LEIDY,1851)

(i) Serrasentis socialis (LEIDY, 1851) VAN CLEAVE, 1924.

Syn. = Serrasentis sagittifer of GOVAN, 1969, et auctt.
= Serrasentis chauhani DATTA, 1954 .- new syn.
= Serrasentis longus TRIPATHI in YAMAGUTI, 1963.
= Serrasentis longa TRIPATHI, 1959. - new syn.

Material : 3 adult (older) males, 3 adult females in final host, 17 immature male and 23 immature females in paratenic hosts.

Final host : *Rachycentron canadus* LINNEUS -(Rachycentridae),

Paratenic hosts : *Platphrys pantherinus* (BLOCH) , Bothidae; *Cynoglossus macrolepidotus* (BLEEKER) , Cynoglossidae , and *Psettodes erumei* GUNTHER, Psettodidae from Cochin ; *Muraenesox cinerius* FORSKAL, Muraenidae, and *Rhynchobatus djeddensis* (FORSKAL), Rhinobatidae from Puri; *Lutjanus johnii* (BLOCH), Lutjanidae, from Calicut, and *Galeoides decadactylus* (BLOCH), Polynemidae, from Lagos, Nigeria.

New localities : (1) Nigeria : Lagos, (Final and Paratenic),
(2) India : Bombay (final host only), Puri, Cochin and Calicut (Paratenic hosts only).

Location : Gut caeca in final host, mesenteries and small intestine in paratenic hosts.

Serrasentis socialis is one of the most widely distributed acanthocephalan parasite of Rachycentrid fishes of the high seas. Adult specimens of this species are,however, being reported from India and from Nigeria for the first time. This species has also been reported recently from Brazil by TRAVASSOS (1969) under the name *Serrasentis sagittifer* . Specimens, adults as well as young, available in the writer's collection entirely conform with the original as well as the revised descriptions given by various investigators (LEIDY, 1851 ; VAN CLEAVE, 1924; VAN CLEAVE & LINCICOME, 1940 ; TRAVASSOS, 1969 ; GOLVAN, 1956, 1969 a, 1969 b). The specimens do exhibit some minor variations but they are to be deemed as intra-specific variations which are met with in the number of combs, location of the testes and occassionally in the number of hooks in each longitudinal rows The testes are small, rounded in immature and young forms whereas they become large, oval and widely seperated in older forms. Likewise the combs extend upto posterior extremity in younger worms but gradually diminish in size and extent in older forms. In the longest male specimen from Lagos the combs do not occur beyond the level of posterior testis. The position of the lemnisci also accordingly depend on the age of the worms. Serrasentis socialis is perhaps a long-living parasite., the length of the parasite increasing with age. Excessive length also indicate the worms are not quite often voided off by the host as it happens in case of other fish-parasitic acanthocephalans.

Juveniles of S. socialis have been found in various paratenic hosts in European, American and Indian fishes. Younger forms recorded in Indian fishes are identical with those found in Galeoides decadactylus in Lagos, and this is an index of global distribution of the species. Such young forms have occassionally been regarded as independent species by certain workers. Serrasentis chauhani DATTA, 1954 and Serrasentis longa TRIPATHI, 1959 are evidently two such species. A comparison of present material with the type specimens of these two specimens leaves no doubt regarding their conspecific identity as younger forms of *Serrasentis socialis*. Both species, *S. chauhani* as well as *S. longa* are described from what have been recorded as paratenic hosts, *Psettodes erumei* and *Lutjanus johnii* in case of former and *Rhynchobatus djeddensis* in case of latter. DATTA's material (ZSI Collection No: W 3803/1) comprised 12 immature specimens which were mostly shrivelled and with partially invaginated proboscis and even the state of preservation was not satisfactory. Similarly the types of *S. longa* TRIPATHI, 1959 (CIFRI Collection ; no accession No.) also comprise immature forms with measurements in close range with those obtained through the paratenic hosts in the present collection. Hence it adds strength to the view that all these specimens pertain to one species, i.e. *Serrasentis socialis* (LEIDY,1851) VAN CLEAVE, 1924 (= *Serrasentis sagittifer*, LINTON, 1889) most widely distributed geographically and that *S. chauhani* DATTA, 1954 and *S. longa* TRIPATHI,1959 are its junior synonyms.

With this, only one more species, *Serrasentis lamelliger* (DIESING,1854) is left in the genus. Except a brief original description by DIESING (1854, s : 681) , followed by another brief report by PORTA (1905: 165, Fig. 13 a-c), this species has never been recorded by any of the subsequent workers. The original description and that of PORTA are too brief and a redescription based on fresh material is warranted which might subsequently affect the systematic position of *S. socialis* if the two happen to be alike.

Family Micracanthorhynchinidae YAMAGUTI, 1963.

1. Genus Micracanthorhynchina (HARAD.1936) STRAND, 1938.

Syn. = Micracanthorhynchus HARADA, 1936 , preocc.

= Micracanthocephalus HARAD, 1938.

= Bolbosentis BELOUS, 1952

Generic diagnosis : Micracanthorhynchinidae of small size. Body fusiform, delicate. Proboscis short cylindrical or claviform, armed with 10-16 longitudinal rows of hooks. Fore-trunk spinose. Lemnisci claviform or elongate spatulate. Testes oval or spherical, tandem and contiguous. Cement glands pyriform or claviform follicles, 4-6 in number. Eggs with polar bulbs in thicker middle shell. Parasites of Hemirhamphidae.

Type species : Micracanthorhynchina motumurai (HARAD,1936).

(i) Micracanthorhynchina indica n. sp.

(Pl. X, Fig. 83-88)

Description based on 4 specimens, 3 males and 1 female with characters of the genus. Body small, fusiform, broader in the middle in males and posterior to middle in females. Proboscis long, claviform, ventrally inclined. Neck short, truncate conical. Fore-trunk narrow, spinose. Proboscis receptacle long, U-shaped with ganglion anterior to its base. Lemnisci claviform, massive, longer than the proboscis receptacle, reaching the middle of the anterior testis in males and past the anterior half of the body length in females. Posterior extremity of females dorsally curved, attenuated. Female genital pore postero-terminal and appended with a digitiform postero-terminal appendix.

Male : 5.9 - 6.5 mm long, 0.9 mm wide at maximum in the mid-body region, 0.25 and 0.3 mm wide at the anterior and posterior extremities respectively. Proboscis claviform, 0.75 mm long, 0.2 mm wide distally, 0.09 mm proximally. Proboscis hooks in 16 longitudinal rows of 12 hooks each; first 8 hooks larger, spiniform with large posteriad roots, remaining hooks gradually diminishing in length with attenuated roots. Measurements of hooks as follows :

Serial No :	I	II	III - VIII	IX	X - XII.	
Hooks :	40	50	60	20	18	u.
Roots :	20	25	25	20	20	u.

Neck 0.2 mm long, 0.1 mm wide at apex, 0.25 mm at base. Anterior 1/4 of trunk beset with minute cuticular spines disposed in 12 transverse rows of about 24 spines per transverse row, each spine about 0.03 mm long. Lemnisci large, claviform, each 1.35 mm long, 0.2 mm wide distally.

Testes rounded, tandem or contiguous, pre-equatorial, commencing from the base of anterior 1/4 of trunk, each 0.7 mm in diameter. Cement glands 6, claviform follicles, each 0.3 x 0.15 mm with ducts about 0.9 mm long. Seminal vesicle elliptical, cylindroid, 0.55 mm long. Saefftigen's pouch dorsal, pyriform, relatively voluminous, 0.45 x 0.25 mm. Bursa 0.45 mm in length with 26 long digitiform rays, each about 0.1 mm long.

Female : Trunk fusiform, narrow at extremities, 4.75 x 1.25 mm with maximum with at the posterior 1/3 of the body. Proboscis 0.8 x 0.18 mm ; its armature and size of hooks same as in males. Neck 0.35 x 0.5 mm. Proboscis receptacle 1.25 x 0.2 mm. Lemniscis 1.45 x 0.2 mm. Genital tract confined to the attenuated posterior body region. Uterus 0.5 x 0.04 mm. Vagina 0.09 mm long. Vaginal sphincters 0.04 and 0.05 mm respectively . Vaginal pore terminal, dorsally orientated. Caudal appendage 0.05 mm long. Eggs elliptical, 60 x 15 u each.

Type host : Hemirhamphus xanthopterus CUVIER & VALENCIENNES.- (Hemirhmphidae).

Type locality : Karwar.
Holotype male, allotype female and 1 paratype (male) deposited in Zoological Museum, AMU, Aligarh.

The genus Micracanthorhynchina was initially proposed as Micracanthorhynchus by HARADA in 1935 but since the generic name was preoccupied with a similar one earlier proposed by TRAVASSOS (1915) for a gigantorhynchid genus, it was changed to Micracanthocephalus, with M. motumurai (HARADA,1935) as its type by HARADA in 1938. In the meanwhile EMBRIK STRAND (1936) proposed the replacement name, Micracanthorhynchina for Harada's genus and renamed the type as Micracanthorhynchina motumurai in a nomenclatorial compendium. HARADA was, however, perhaps unaware of this emendment since in 1938 he described the second species in this genus under the name Micracanthocephalus dakusuensis which was later assigned to the present genus by WARD (1951). BAYLIS (1944) addedc the third species, *Micracanthocephalus hemirhamphi* from Otago Harbour, New Zealand. BELOUS (1952) proposed another genus, *Bolbosentis* for a similar parasite species and designated *B. hyporhamphi* as its type. PETROCHENKO (1956) has considered *Bolbosentis* as a direct synonym of *Micracanthorhynchina* and *B. hyporhamphi* BELOUS, 1952 of *M. hemirhamphi* (BAYLIS,1944). This species (*B. hyporhamphi*) has, perhaps, by an error, cited as *B. sjori* - BELOUS,1952 as a synonym of *Micracanthorhynchina sajori* (BELOUS) by GOLVAN (1969 : 114) but such a name was never proposed by BELOUS (1952) and should, therefore, be regarded as a nomen nudum.

M. dakusuensis HARADA, 1938 is almost identical with *M. motumurai* HARADA, 1935 and except some minor variations, does not differ from the latter to any significant extent and should, therefore, be considered a junior synonym of the latter. Both are incidentally from the same host, *Zacco temminkii* and from adjacent localities; *M. motumurai* from Tamsui, Taiwan and *M. dakusuiensis* from Dakusui, Taiwan.

Recently DEMSHIN (1965) has added another species, *Micracanthocephalus hemiculturus* to this group but this species does not appear to belong in the genus *Micracanthorhynchina* since it lacks trunk spines ; instead it appears to belong to the genus *Pseudocavisoma* GOLVAN & HOUIN,1964 and is, therefore, renamed as *Pseudocavisoma hemiculturum* (DEMSHIN,1965) comb. novo.

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The present species, Micracanthorhynchina indica, n.sp., is the first member of this genus to be reported from the Indian region and thus becomes the third species under this group. In having an elongate olviform proboscis and an appendiculated posterior extremity in the female, M. indica n. sp. comes closer to M. hemirhamphi (BAYLIS,1944) from which it can, however, be differentiated on the basis of the number and size of proboscis hooks which are more and larger in the former than in the latter, and also in the shape and extent of the lemnisci which are longest in the present species than in any other one. The number of cement gland follicles also differ in the two species; they are 4 in M. hemirhamphi and 6 in Micracanthorhinchina indica.

Key to species of the genus Micracanthorhynchina

(1) a- Proboscis armed with 12 longitudinal rows of hooks, lemnisci as long as the proboscis receptacle ..... (2)

b- Proboscis armed with 16 longitudinal rows of hooks, lemnisci much longer than the receptacle, extending upto mid of anterior testis .... M. indica.

(2) a- Proboscis cylindrical; posterior extremity of female rounded, no appendix .... M. motomurai.

b- Proboscis claviform; posterior extremity of female with a digitiform appendix .... M. hemirhamphi.

2. Genus *Mehrarhynchus* DATTA, 1940, emend.

Syn. = *Rhadinorhynchus* sensu TRIPATHI, 1959
= *Cleaveius* of GOLVAN, 1969 non SUBRAHMANIAN, 1927.
= *Indorhynchus* GOLVAN, 1969.

Generic diagnosis : Micracanthorhynchinidae of small size with marked sexual dimorphism; males smaller than females. Trunk fusiform, convex dorsally. Proboscis claviform or cylindrical, with 12-24 longitudinal rows of hooks gradually diminishing in length antero-posteriorly. Neck short, conical, distinct. Fore-trunk narrow, constricted, spinose, beset with 10-15 circular or semi-circular rows of sharp cuticular spines more extensive ventrally than dorsally specially in females. Proboscis receptacle sub-cylindrical, extending upto the middle of the body. Lemnisci long, tubular or fusiform, longer than the receptacle, extending upto the mid-body region. Testes broadly tandem or contiguous, nearer to posterior than to anterior body region. Cement glands pyriform, 4-8. Seminal vesicle voluminous, pyriform. Bursa bell-shaped, relatively large. Posterior extremity of femlae with 2-4 conical papillae on either side of the vaginal pore. Eggs spindle-shaped. Parasites of esturine and marine fishes.

Type species : *Mehrarhynchus prashadi* DATTA, 1940

(i) Mehrarhynchus alami n. sp.

(Pl. XI, Fig. 89-95)

Description based on 5 specimens, 3 males, 2 females, with characters of the genus. Body fusiform, more convex dorsally than laterally. Proboscis cylindroid, 0.9 mm long; beset with 24 longitudinal rows of 14 hooks each with size of hooks per row as follows:

(in micra)

Ser. No	I	II	III	IV-VI	VII	VIII-X	XI	XII-XIII	XIV
Hook	50	60	60	60	60	50	50	50	50
Root	35	35	40	50	45	40	35	20	15

Neck short, truncate, conical. Fore-trunk narrow, set-off from the median broader part of the trunk, with 10-12 transverse rows of sharp cuticular spines, each measuring about 20 u in length. Lemnisci elongate, fusiforme extending past the anterior testis in males. Posterior extremity of females with few large tactile conical papillae.

Male : 3.6 - 4.2 mm long, 0.35 mm wide anteriorly and 0.45 mm in the broader middle region. Proboscis 0.7 x 0.25 mm. Neck 0.12 mm long, 0.2 mm wide at base. Number and size of hooks as per table given above. Anterior hooks with large posteriad roots, proximal 3 hooks of each row broader spiniform with anteriad roots. Proboscis receptacle narrow U-shaped, 1.2x0.2 mm. Lemnisci 1.1-1.3 mm long each. Retinacula ventral and posteriad.

Testes oval, broadly contiguous, partly overlapping, each about 0.35x0.3 mm. Cemnt glands 6, three on each side, pyriform follicles in pairs of 3 each ; each 0.65 mm long, 0.02 wide distally. Cement ducts thick, long, tapering proximally. Seminal vesicle large, pyriform, 0.35x0.2 mm with duct about 0.2 mm long. Bursa sub-spherical, 0.4 x 0.35 mm.

Female : 6.5 x 0.9 mm . Proboscis 0.75 x 0.25 mm. Proboscis hooks same as in males. Neck slightly larger. Fore-trunk with 10-12 circular rows of spines, each with about 24 per row. Female genital tract confined to the narrow posteriorregion of the trunk. Uterine bell short, goblet shaped. Uterus tubular, thick-walled, about 1.5 mm long. Vaginal sphincters tandem, 100 and 70 u across each respectively. Two genital papillae on ventral and two on dorso-lateral side of the genital pore, each ca. 10 u long. Eggs spindle-shaped, 60x15 u each, with polar prolongations in the thick middle shell.

Type host : Arius nenga HAMILTON-BUCHANAN - (Ariidae).

Type locality : Madras, T.N.

Holotype male, allotype female and paratypes in Zoological Museum, AMU, Aligarh.

The species is named after Professor S.M. Alam, Head,Zoology Department, AMU, Aligarh.

The genus Mehrarhynchus was originally founded as a monotypic entity with M. prashadi DATTA, 1940 as its nominal type. Later on, TRIPATHI (1959) added one more species, M. secundus to this group. He (TRIPATHI,1959) also described another closely related form, Rhadinorhynchus indicus in the same study and characterised it by the presence of 8 cement gland follicles. For this reason GOLVAN (1969) placed it under a new genus, Indorhynchus, of which he designated the former as nominal type. This proposition is not acceptable to the present author because the number of cement gland follicles varies among the various species of the constituent genera of Micracanthorhynchinidae to fresquently that it not be regarded as a decicive character for the creation of a genus at it. At best this can be deemed a character of specific significance only. The females can not, however, be distinguished from each ot er under the two generic entities otherwise. A study and re-examination of the type specimens of the two species, *Mehrarhynchus secundus* TRIPATHI and *Indorhynchus indicus* (TRIPATHI) GOLVAN alludes the possibility of congenric nature of the two. Comparison of types of *Mehrarhynchus secundus* TRIPATHI, *Mehrarhynchus prashadi* DATTA (Indian Museum Collection No: W 3438/1) and of *Rhadinorhynchus indicas* TRIPATHI (CIFRI Collection ; courtesy Y.R. TRIPATHI) leads to the conclusion that all three belong in the same genus and that *R. indicus* TRIPATHI is an intermediate form, providing a link between *M. prashadi* and *M. secundus*. This, therefore, renders the genus *Indorhynchus* GOLVAN,1969 untenable and *Indorhynchus indicus* -GOLVAN as nomen nudum. The latter should,therefore, be relegated to the genus *Mehrarhynchus* and is accordingly renamed as *Mehrarhynchus indicus* (TRIPATHI,1959) n.comb.

To complicate matters further, GOLVAN (1969:108) has considered *Mehrarhynchus* a junior synonym of the genus *Cleaveius* SUBRAHMANIAN,1927. The decision appears more hypothetical and presumptive than factual. The genus *Cleaveius* is actually synonymous with *Pallisentis* since *Cleaveius circumspinifer* SUBRAHMANIAN,1927 is in all probability a poorly preserved and prepared specimen of Pallisentis nagpurensis (BHALERAO). SUBRAHMANIAN (1927) had assumed the cement gland, cement reservoir, seminal vesicle and the Saeffitigen's pouch in his speciemns as 4 discrete follicles and this has perhaps perpetuated the concept of Cleaveius with 4 pyriform cement glands. Secondly, Cleaveius circumspinifer has been reported from 'an unidentified fresh-water fish' of Rangoon, Burma and that perhaps was an ophiocephalid murrel for the diagram of C. circumspinifer strongly suggests its identity with P. nagpurensis which is one of the commonest gyracanthocephalan parasite of murrels of South-East Asia. The present aut or has, therefore, reasons to belive th t Cleaveius is not a tenable concept and that Mehrarhynchus should not be conceded as a synonym of it unless it is ratified appropriately. Till then all the species accredited to Cleaveius are to be regarded sub-judice and those belonging to Mehrarhynchus are relegated to their original generic epithet.

Mehrarhynchus alami, the new species, happens to be the third member of the genus. It comes closer to M. prashadi DATTA in ceratin respects but can be differentiated from all the other of its congeners through the number of proboscis hooks, their arrangement and size, and in the numbero of cement glands also. The females of M. alami may further be characterised by the presence of conical caudal papillae which are not found in any other species of the corresponding genus.

Key to species of the genus Mehrarhynchus.

(1) a: - Proboscis with 18-22 longitudinal rows, 4 cement glands in males .... (2)

b: - 22-24 longitudinal rows of hooks; cement glands more than 4 follicles .... (3)

(2) a: - 12-14 hooks in each longitudinal row; largest hooks (subapicals) 80 u or more in length...... .... *M. prashadi*.

b: - 16-18 hooks in each longitudinal row, largest hooks (sub-apicals and medians) upto 50 u in length .... *M. secundus*.

(3) a: 22 longitudinal rows of hooks; trunk spines in 9 circular rows; 8 cement glands .... *M. indicus*.

b: 24 longitudinal rows of hooks ; trunk spines in 12 circular rows; 6 cement glands .... *M. alami*.

Family Echinorhynchidae COBBOLD, 1879

Subfamily Echinorhynchinae TRAVASSOS, 1920

1. Genus Acanthocephaloides MEYER, 1932.

Syn. = Echinorhynchus MULLER, 1876, partim.,

= Paracanthocephaloides GOLVAN, 1969, new synonym,

= Acanthocephaloides of GOLVAN ney MEYER, 1932.

Generic diagnosis: Echinorhynchidae, Echinorhynchidae of smaller size. Body elongate or fusiform. Proboscis elongate oval or globular. Proboscis hooks of two different types; anterior hooks of each row much longer than posterior 3 Or 4 of corresponding row; the latter being abruptly smaller in size. Neck distinct. Lemnisci digitiform, as long as or longer than the receptacle. Ganglion basal. Testes tandem, contiguous. Cement glands pyriform, in 6 follicles; pairs of 3 each. Eggs elliptical with polar bulbs in middle shell. Parasites of marine fishes.

Type species : Acanthocephaloides propinquus (DUJARDIN, 1845).

(1) Acanthocephaloides venustus n. sp.

(Pl. XII, Fig. 96-99)

Numerous specimens of this species were found in various marine fishes of Indian waters (list appended). Specimens with characters of the genus as delineated by MEYER (1932). Body small, fusiform, inflated ventrally. Proboscis elongate oval, ventrally inclined, beset with two distinct types of hooks; relatively much laenger anterior (apical and sub-apicals) and markedly smaller acutely curved posterior hooks disposed in linear rows. Neck short, conical, smooth. Proboscis receptacle elliptical, inset in the middle of the presoma, demarcating the latter into proboscis and neck. Lemnisci elongate digitiform, longer than the receptacle. Ganglion oval, basal.

Male : 3.7 - 4.5 mm long, 0.8 mm wide at maximum in the mid-body region, 0.25 mm elsewhere. Extremities narrow and tapering. Proboscis 0.36 x 0.2 mm. Proboscis hooks in 12 longitudinal rows of 8 hooks each, 4 larger and 4 smaller per linear row. Apicals 60 u long with roots of corresponding ones 40 u ; sub-apicals (II) 90 u long with root, 60 u in length; III & IV of each row 110 u long with roots upto 60 u long. Basal hooks recurved, arcuate, with relatively larger roots; each hooks about 18 u long; root of each upto 20 u long. Neck 0.15 mm long, 0.2 mm wide at the base. Proboscis receptacle 0.5 x 0.15 mm. Lemnisci equal in length, each 0.9 x 0.1 mm.

Testes oval or elliptical, contiguous, partly overlapping, post-equatorial, each 0.5 x o.25 mm, Cement glands 6, in tandem pairs of of ellipsoidal follicles situted immediately behind the testes; each follicle 0.17 x 0.1 mm distally with ducts about 0.45 mm in length. Seminalvvesicle elongate fusiform, 0.3 mm long. Saeffitigen's pouch 0.32 x 0.15 mm. Bursa bell-shaped with dorso-lateral dome-shaped paired diverticula and with 24 slender digitiform bursal rays. Total length of vestibule 0.15 mm.

Female : Trunk fusiform but relatively more slender than in males, 5.0 x 0.65 in allotype female. Proboscis 0.3 x 0.18 mm. Number, size and arrangement of proboscis hooks same as in males. Proboscis receptacle 0.75 x 0.17 mm. Lemnisci reaching upto 1/5th of body length posteriorly; each 1.0 x 0.0 mm. Female genital tract confined to posterior 1/3 of the trunk length. Uterine bell elliptical, 0.09-0.0.8 x 0.6 mm. Uterus slender, tubular, with uniform diameter, 1.8 x 0.09 mm. Vaginal sphincters 60 u and 45 u across respectively. Genital pore postero-terminal, with 4 large pyriform perivaginal glands. Eggs elliptical with distinct polar bulbs in the thicker middle shell; each 60 x 20 u.

Type host : *Cynoglossus macrolepidotus* (BLEEKER) -(Cynoglossidae).

Type locality : Calicut.

Other hosts : *Polynemus plebius* (BLOCH) (Polynemidae);
Cynoglossus brevis GUNTHER (Cynoglossidae);
Plotosus canius (HAMILTON BUCHANAN) (Plotosidae).

Other localities : Veraval; Cochin.

The genus *Acanthocephaloides* was created by MEYER (1932) to include the three species, *A. propinquus* (DUJARDIN,1845), the nominal type, *A. incrassatus* (MOLIN,1858) and *A. kostylewi* MEYER,1932 YAMAGUTI (19350 and (1939) added two more species, *A. rhinoplagusiae* and *A. neobythitis*, respectively, from Japan. DOLLFUS (1951) described *A. chabanaudi* from *Cynoglossus zanzibarensis* of Zanzibar and recently GOLVAN (1969) has made one more addition by describing

Acanthocephaloides distinctus from various fishes of Dakar, Senegal. Acanthocephaloides venustus n. sp. is the first member of this genus being reported from the Indian region. This species comes close to A. chabanaudi DOLLFUSS (1951) but differs from the latter in the general shape of the body and in the number and arrangement of proboscis hooks, particularly the posterior spiniform hooks of each linear row. In A. chabanaudi the trunk is elongate cylindrical, with uniform diameter, whereas in A. venustus it is distinctly fusiform and ventrally inflated. Further, the smaller hooks of each linear row alternate as 3 and 4 in each row but in A. chabanaudi such alternation does not occur and the number remains constant 4.

GOLVAN (1969) has recently made another important emendment in the taxonomic status of the genus. He has spilitted the genus into two; those with spinose trunk are restricted to Acanthocephaloides (A. propinquus as type) whereas those with aspinose trunk are included in another genus, Paracanthocephaloides GOLVAN,1969, with Paracanthocephaloides chabanaudi (DOLLFUS,1951) as its type species. The two Japanese species, A. rhinoplagusiae YAMAGUTI and A. neobythitis are also removed from Acanthocephalus and are,instead, assigned to another newly created genus, Yamagutisentis GOLVAN,1969 which that author has assigned to a new subfamily, Yamagutisentinae. Whereas the present writer subscribes to the latter amendment, he does not tend to submit the former view of GOLVAN (1969) who has infused the change because he has observed regular transverse rows of cuticular spines on the trunk of A. propinquus (sensu GOLVAN) specimens he obtained at Sete, Golfe du Lion, French Mediterranean Coast.

The present writer has had the opportunity of studying the type specimens of A. propinquus (Berlin Museum , No.1169, 1170, 1171, RUDOLPHI Collection) through the courtesy of Dr Gerhard Hartwich, but could not find any trace of cuticular spines in any of the numerous specimens. Those specimens (in 3 lots; one from Sciaena umbra , collected at Spezza, Mediterranean Coast; the other (No. 1170) from Gobius niger at Naples and the third lot, No: 1171, from Pleuronectes linguatulus at Naples; each lot containing numerous specimens) are precisely in conformity with the original description and concept of the genus as MEYER (1932) instituted. The writer is, therefore, of the opinion that what GOLVAN (1969) has described as A. propinquus should better be assigned to the genus Neoacanthocephaloides CABLE & QUICK,1954 since it agrees with the generic concept of the latter. The species will therefore be renamed as Neoacanthocephaloides golvani nom. et comb. novo. The genus Acanthocephaloides is proposed to be restricted to those species which fall within the original concept of the genus as enunciated by MEYER (1932). Likewise A. distinctus GOLVAN,1969 too shall be relegated to Neoacanthocephaloides as N. distinctus (GOLVAN,1969) comb. nov. Acanthocephaloides soleae (PORTA,1905) PETROCHENKO,1956 conforms more with Acanthocephalus in the pattern of its proboscis organization whereas Paracanthocephaloides plotosi (YAMAGUTI,1935) GOLVAN,1969 too is incompatible either with the concept of Acanthocephaloides or of Paracanthocephaloides since it bears 'minute spines' on the fore-trunk, a factor on the basis of which YAMAGUTI (1935, 1939) had appropriately assigned it to the genus Heterosentis and where it should now belong too.

Key to species of the genus Acanthocephaloides

(1) a - Proboscis globular, neck obliterated, proboscis hooks in 16 longitudinal rows of 4 - 6 each .... *A. kostylewi*.

b - Proboscis oval or cylindrical, neck distinct, proboscis hooks in 12 longitudinal rows .... (2)

(2) a - Trunk elongate cylindrical, proboscis oval, hooks 4 + 2 in each row .... *A. chabanaudi*.

b - Trunk fusiform, proboscis oval or cylindrical with 6-8 hooks in each row .... (3)

(3) a - 8 hooks in each row; smaller hooks alternating with 3 and 4 in each linear row, proboscis oval..... .... *A. venustus*.

b - 5 - 6 hooks in each row; proboscis cylindrical; smaller hooks alternating 2 and 3 in each ..... (4)

(4) a - Lemnisci as long as the proboscis receptacle, testes prevequatorial.................... *A. propinquus*.

b - Lemnisci twice longer than the proboscis receptacle, testes post-equatorial .... *A. incrassatus*.

Family Mirzasentidae n. fam.

Palaeacanthocephala of medium size. Body elongate, cylindrical, aspinose. Proboscis short, claviform or sub-cylindrical, armed with 20 longitudinal rows of hooks. Neck distinct, short, cylindrical. Lemnsci typically modified into a ring-like collar arond the proboscis receptacle at the base of the neck. Testes oval, tandem, pre-equatorial. Cement glands 6, pyriform, in posterior 1/3 of the trunk. Eggs fusiform with polar bulbs in the thicker middle shell. Parasites of marine fishes.

Type genus : Mirzasentis n. gen.- type by monotypy.

1. Mirzasentis n. gen.

Generic diagnosis : Mirzasentidae : Trunk smooth, wider anteriorly and tapering posteriorly. Proboscis short, terminal, cylindrical, armed with 20 longitudinal rows of hooks. Neck short, cylindrical, smooth, basally circumvellate. Proboscis receptacle elongate oval, inserted in the posterior 1/3 of the presoma. Cerebral ganglion basal. Lemniscular collar at the apex of the receptacle, immediately behind the neck. Collar ruff-like with numerous vertical frills. Testes oval or elliptical, tandem , pre-equatorial, in the anterior 1/3 of the trunk. Cement glands 6 pyriform follicles , close together, in diagonally tandem pairs, distantly seperated from the testes and located in the posterior 1/3 of the trunk. Ovary elongate fusiform. Uterus thin walled. Eggs with polar bulbs in the middle shell.

Type species : Mirzasentis torquis n.gen et sp.

The genus *Mirzasentis* is named after Professor M.B.Mirza.

(1) *Mirzasentis torquis* n. sp.

(Pl. XIII, Fig. 100-106)

Description based on 6 male and 11 female specimens with characters of the genus. Medium sized forms with marked sexual dimorphism: females being longer than the males. Body elongate cylindrical, wider anteriorly and tapering posteriorly. Anterior extremity rounded in detatched worms, circumvellate crateriform while alive and affixed with the hosts gut. Proboscis terminal or sub-terminal, slightly inclined in females. Proboscis hooks in 16 longitudinal rows of 8 hooks each. Neck sub-cylindrical or conical; smooth.

Males : 10.6 - 12.5 x 1.0 - 1.25 mm (Holtype male 11.5 mm long, 1.2 mm wide anteriorly, 0.8 mm posteriorly). Proboscis oblong, 0.35 x 0.25 mm in holotype male. Proboscis hooks 8 in each longitudinal row, the last two of each row being spiniform and more arcuate than others and with shorter roots : measurements of hooks as per table given below : all measurements in micra.

Ser. No:	I	II	III	IV	V	VI	VII	VIII.
Hook :	20	25	25	35	30	30	20	30
Root :	18	20	20	25	20	20	10	10

Neck short, conical in holotype male, 0.25 mm long, 0.18 mm wide distally, 0.27 mm wide proximally. Proboscis receptacle flask-shaped, 0.8 x 0.25 mm. Cerebral ganglion basal, 0.1 x 0.07mm. Lemniscular collar (ruff) 0.5 - 0.6 mm in diameter (Pl.XIII, Fig. 104).

Testes oval, tandem, contiguous or separate, in anterior middle of the trunk, each 1.0 x 0.5 mm. Cement glands 6 pyriform or ellipsoidal follicles in posterior 1/5 of the trunk; anterior pair obliquely tandem, remaining juxtaposed, each follicle 0.4 x 0.2 mm. Seminal vesicle elongate fusiform, 0.5 mm long. Saefftigen's pouch large, pyriform, with sigmoid neck, 0.8x0.25 mm. Bursa 0.8 x 0.75 mm with 16 bursal rays.

Female : 12.0 - 15.75 mm long, 1.2 - 1.35 mm wide anteriorly, 0.7 - 0.8 mm wide wide posteriorly. Proboscis in allotype female sub-terminal, claviform, 0.4 x 0.3 mm. Number and measurements of proboscis hooks same as in males. Neck 0.25 x 0.15 mm. Proboscis receptacle 0.75 x 0.27 mm with ganglion, 0.1 x 0.05 mm at the base. Lemniscular collar 0.60 - 0.75 mm in diameter.

Ovary fusiform, 3.8 - 4.5 x 0.25 mm, situated in anterior middle of the trunk. Uterine bell goblet-shaped, 0.32 x 0.18 mm with dorsal and ventral conoid diverticula. Uterus tubular, distally attenuated, 1.75 x 0.07 mm. Vaginal sphincters sub-equal, anterior sphincter 75 u and posterior 60 u in diameter. Vagina oblique. Vaginal bulb 0.065 mm wide. Female genital pore ventro-terminal. Eggs fusiform, each .65 - 75 x 15 - 25 u, with elongate polar bulbs in the middle shell.

Type host : Synaptura orientalis BLOCH & SCHNEIDER - (Pleuronectidae).

Other hosts : Sillago sihama FORSKAL - (Sillaginidae), Tylosurus strongylurus VAN HASSELT - (Belonidae).

Type locality : Karwar, Malabar Coast.

Other localities : Tuticorim, Calicut.

Holotype male, allotype female and paratypes deposited in Zoological Museum, AMU, Aligarh.

The systematic position of the genus Mirzasentis and the new family, Mirzasentidae is discussed in Chapter V.

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Family Pomphorhynchidae YAMAGUTI, 1939

1. Genus Longicollum YAMAGUTI, 1935.

Generic diagnosis : Trunk elongate, anteriorly broad, posteriorly tapering. Presoma relatively long, usually convex. Proboscis short, sub-cylindrical. Neck smooth, cylindrical, many-times longer than the proboscis; may be attenuated proximally. Lemnisci short, tubular, digitiform, may be wanting. Presomal bulb - the bulla - absent. Lacunar system anastomosed. Proboscis receptacle inserted far ahead in the presoma, at the base of the proboscis. Ganglion oval, median or basal, Cement glands 6, oval or ellipsoidal. Ovary elongate, fusiform, massive. Eggs elliptical or spindle-shaped with polar bulbs in the middle shell. Parasite of marine fishes.

Type species : Longicollum pagrosomi YAMAGUTI, 1935.

(1) Longicollum pulcher n. sp.

(Pl. XIV, Fig. 107-114)

Numerous specimens belonging to the present species were obtained from the hosts (list appended) at various localities. With characters of the genus Longicollum YAMAGUTI, 1935. Trunk fusiform, slender, broader anteriorly, tapering posteriorly. Presoma (proboscis + neck) cylindrical, curved (-shaped or bent at an angle of about 45 to the principal axis of the body. Proboscis short, cylindrical or ellipsoidal, anteriorly rounded, posteriorly cylindroid, with 12 longitudinal rows of 14 hooks each, the basals being larger and forming the corona radiata. Neck long, cylindrical, arcuate, ratio between proboscis and neck 1 : 2.5. Proboscis receptacle elongate, elliptical, fairly long, inserted anteriorly at the level of the basal hooks of corona radiata, posterior 1/3 within the fore-trunk region, remaining traversing the neck. Cerebral ganglion oval, nearer base of the receptacle. Lemnisci short, digitiform, as long as the metasomal portion of the receptacle, occassionally up-turned. Proboscis and neck retractors and protractors forming a skeleto-muscular pattern in the anterior 1/4 of the trunk. Lateral longitudinal lacunar vessels persistent ; remaining system diffused and reticular forming short polygonal anastomoses. Testes rounded or oval; pre-equatorial. Female genital pore postero-terminal. Eggs elliptical or spindle-shaped, with polar bulbs in the thick middle shell.

Males : Body 8.0 - 9.5 long, 1.0 - 1.5 mm wide anteriorly, 0.25 - 0.3 mm posteriorly. Proboscis 0.9 - 1.0 long, 0.32 mm wide anteriorly, 0.22 mm posteriorly. Measurements of proboscis hooks (in micra) as follows :

Ser.No :	I	II	III	IV	V	VI	VII-X	XI-XIII	XIV
Hooks :	45	50	45	40	30	30	40	40	60-70
Roots :	30	35	30	30	25	25	20	15	25-30

Neck arcuate, 2.2 x 0.35 mm. Proboscis receptacle 2.85 x 0.15 m, about 0.8 mm inside the fore-trunk. Cerebral ganglion oval. Lemnisci equal in length, each about 0.5 mm long.

Testes ellipsoidal, tandem, pre-equatorial, near base of proboscis receptacle ; 0.6 x 0.35 and 0.54 x 0.3 mm respectively. Cement glands 6 pyriform follicles, in three tandem pairs, slightly behind the posterior testis, each follicle 0.2 x 0.15 mm, with corresponding ducts about 1 mm long each. Seminal vesicle elongate fusiform, 0.65 x 0.1 mm. Saefftigen's pouch pyriform, enlarged anteriorly, 0.9 x 0.19 mm. Bursa 1.0 x 0.3 mm. Bursal cap dome-shaped, with 16 short digitiform bursal rays.

Female : upto 10 mm long, 0.35 - 0.5 mm wide anteriorly. Proboscis 0.85 x 0.15 mm distally, 0.2 mm proximally. Neck 2.15 mm long, 0.25 mm wide. Number and measurements of proboscis hooks same as in males. Trunk (metasoma) 5.0 x 0.35 mm wide anteriorly, 0.2 mm posteriorly. Proboscis receptacle 2.8 - 3.0 x 0.3 mm. Lemnisci 0.5 x 0.05 mm in young females, upto 1 mm long in gravid females. Uterine bell vase-shaped, in posterior middle of trunk, 0.14 x 0.1 mm, with two antero-lateral diverticula. Ovary large, fusiform, usually sigmoid. Gravid ovary 1.87 x 2.2 mm; isthmus 0.05 mm. Uterus long, slender, o.9 - 1.5 mm, club-shaped, posteriorly distented in gravid females. Sphincters tandem, 0.05 and 0.07 mm across.respectively. Vaginal funnel 0.1 mm long. Genital pore postero-terminal. Eggs elliptical, 50 x 12 u each.

Type host : Gerres limbatus CUVIER & VALENCIENNES-(Gerridae),
Other hosts : Synaptura orientalis BLOCH & SCHNEIDER - (Pleuronectidae) ; Lutianus argentimaculatus (FORSKAL), Lutianus johni (BLOCH) (Lutjanidae); Plotosus canius HAMILTON (Plotosidae) ; Pristipoma hasta (BLOCH) (Pristipomatidae); Cynoglossus brevis GUNTHER, C. macrolepidotus (BLEEKER) (Cynoglossidae) ; Polynemus sinereus (CUVIER & VALENCIENNES) (Polynemidae) ; Nemipterus japonicus (BLOCH) (Percidae).

Type locality : Calicut.
Other localities : Karwar ; Veraval ; Veraval.
Holotype male, allotype female and various paratypes in Zoological Museum, AMU, Aligarh.

Longicollum pulcher n. sp. comes close to *L. edmondsi* (JOHNSTON & EDMONDS,1951) GOLVAN , 1969 but differs from the latter in the presomal ratio (neck ; proboscis = 2:1 in the former and 4:1 in the latter), presence of corona radiata which is absent in the latter and also in the more posteriad location of the cement glands in the Australian species whereas in *L. pulcher* the cement glands are located in the posterior middle of the trunk.

Key to species of the genus Longicollum.

(1) a - Lemnisci present .... (2)
    b - Lemnisci absent .... (4)

(2) a - Testes pre-equatorial, ratio between proboscis and neck = 1:2 - 1:4 .... (3)
    b - Testes post-equatorial, ratio between proboscis and neck = 1:6 .... *L. sergenti*.

(3) a - Ratio 1:4, corona absent, cement glands in posterior extremity distantly from posterior testis .... *L. edmondsi*.

    b - Ratio 1:2, corona present, cement glands nearer posterior testis .... *L. pulcher*.

(4) a - Proboscis much shorter than the neck ..... (5)
    b - Proboscis slightly smaller than or as long as the neck.................................. (6)

(5) a- Body robust, neck dorsally inflated, convex, proximally attenuated or constricted .... *L. pagrosomi*.

b- Body slender, neck fairly long and spirally twisted .... *L. alemniscus*.

(6) a- Proboscis short, anteriorly spheroidal, Ratio 1 : 1.3 : 12 longitudinal rows of hooks .... *L. chabanaudi*.

b- Ratio 1:1, hooks in 16 longitudinal rows of 10 each, no dorso-ventral differentiation in the shape and size of hooks .... *L. riouxi*.

c- Ratio 1:1, hooks in 14 longitudinal rows of 10 each, dorso-ventral differentiation in shape and size of hooks distinct .... *L. noellae*.

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Family Filisomatidae VAN CLEAVE,1928, emend.

Palaeacanthocephala of medium size. Body elongate, slender, cylindrical, smooth or with distinct pseudosegmentation. Proboscis elongate, cylindrical, vertical or arcuate, with numerous longitudinal rows of simple hooks situated in linear pattern. Neck short. Proboscis receptacle elongate, U-shaped. Lemnisci digitiform spatulate, as long as the proboscis receptacle or long, tubular, convoluted, much longer than the proboscis receptacle. Trunk smooth, nonspinose. Hypodermic musculature thin and delicate (Filisoma) or thick and robust (Parafilisoma n. gen.). Testes pre-equatorial or post-equatorial. Cemnt glands elongate, tubular, 4. Eggs with polar bulbs. Parasites of marine fishes.

Type genus : Filisoma VAN CLEAVE, 1928.

The family Filisomatidae (originally named Filisomidae) was proposed by VAN CLEAVE (1928) to include the type and only genus, Filisoma VAN CLEAVE, 1928. MEYER (1932) does not appear to have recogniaed this family since he assigned Filisoma to the family Rhadinorhynchidae. PETROCHENKO (1956) and later YAMAGUTI (1963) too appear to hold similar opinion since they have ascribed Filisoma to the family Cavisomatidae (VAN CLEAVE,1931). In the mean while GOLVAN (1960) first suppressed it as subfamily Filisomatinae under the family Gorgorhynchidae (paradoxically so) but later, in 1969, deleted the former and included the genus Filisoma within the family Fessisentidae VAN CLEAVE, 1931.

For reasons discussed later in the present study (Chapter V), the author does not tend to agree with the above mentioned decisions of PETROCHENKO (1956), YAMAGUTI(1963) and GOLVAN (1960, 1969)and instead, prefers to relegate the genus Filisoma with the family Filisomatidae (the latter emended to some extent) along with another genus, Parafilisoma, being proposed as new in this study. These two genera, therefore, constitute a distinct group which aptly conforms with the basic concept of the family Filisomatidae VAN CLEAVE,1928.

Key to genera of the family Filisomatidae

(1) - Trunk slender, smooth; Lemnisci spatulate digitiform, as long as the proboscis receptacle ;testes post - equatorial .... *Filisoma*.

(2) - Trunk robust, pseudosegmented. Lemnisci tubular, much longer than the receptacle ; testes pre- equatorial .... *Parafilisoma*, n. gen

1. Genus Filisoma VAN CLEAVE, 1928.

Generic diagnosis : Filisomatidae as emended above. Body slender with delicate this hypodermal musculature. Proboscis elongate, cylindrical, arcuate, with numerous longitudinal rows of hooks exhibiting dorso-ventral differentiation in shape and size. Neck short. Lemnisci digitiform, spatulate, as long as, or slightly longer than the proboscis receptacle. Ganglion basal. Testes oval, tandem, post-equatorial. Cement glandss 4, elongate, tubular, with uniform diameter, occupying less than half of the total body length. Posterior extremity of female rounded, swollen, female genital pore subterminal. Eggs elliptical with polar bulbs. Parasites of marine fishes, mainly Scatophagidae.

Type species : *Filisoma indicum* VAN CLEAVE, 1928.

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<u>(i) *Filisoma indicum* VAN CLEAVE, 1928.</u>

Synonyms :- <u>*Filisoma scatophagusi*</u> DATTA & SOOTA, 1962 ; n. syn.

= <u>*Filisoma hoogliensis*</u> DATTA & SOOTA, 1962 ; n. syn.

Material : 6 specimens ; 3 males and 3 females.

Locality : Karwar, India.

The genus <u>*Filisoma*</u> VAN CLEAVE, 1928 is represented by seven species; three of these, <u>*Filisoma indicum*</u> VAN CLEAVE, 1928, <u>*F. scatophagusi*</u> DATTA & SOOTA, 1962 and <u>*F. hoogliensis*</u> DATTA & SOOTA, 1962 from India and all these three from the same host, <u>*Scatophagus argus*</u> and that too from the same (type) locality - Calcutta. The material available to the present author was also recovered from the same host. This material was compared with the type specimens of <u>*Filisoma indicum*</u> (Indian Museum & ZSI Collection No: VC 1733; 2 paratype males and 1 paratype female), of <u>*F. hoogliensis*</u> (Indian Museum & ZSI Collection No: W 3988/1) and of <u>*Filisoma scatophagusi*</u> (Indian Museum & ZSI Collection No: W 3989/1) and all these three species were found to be identical and congeneric with each other. There appears no appreciable difference among these three and whatever has been taken into account by DATTA & SOOTA (1962) could only be regarded as intra-specific variations. Consequently the latter two species, namely, <u>*Filisoma hoogliensis*</u> DATTA & SOOTA, 1962 and <u>*Filisoma scatophagusi*</u> DATTA & SOOTA, 1962 are regarded as junior synonyms of <u>*Filisoma indicum*</u> VAN CLEAVE, 1928.

Likewise, *Filisoma rizalensis* TUBANGUI & MASILUNGAN, 1942 also from *Scatophagus argus* of Manila, Philippines has measurements similar to those given by VAN CLEAVE (1928) and later by YAMGUTI (1954) for *Filisoma indicum* except the hooks of the two sub-median rows are dese ibed by TUBANGUI & MASILUNGAN (1942) as broader and stout than the rest; this is so in *F. indicum* also but was not originally noted by VAN CLEAVE (1928), in all other respects otherwise, the two, *F. rizalinum* and *F. indicum* are identical and perhaps it would not be improper if the former is considered as a junior synonym of the latter. The range of geographical distribution of *Filisoma indicum* would therefore extend more eastward ; from India (Calcutta; Lake Barkul, Chilka; Karwar) to Philippines (TUBANGUI - & MASILUNGAN, 1942) through Celebes (YAMAGUTI, 1954).

Among the remaining three species, *Filisoma microcanthi* HARADA, 1938, known from a single immature female specimen from a chaetodontid fish, *Microcanthus strigatus* of Tamsui, Formosa (now Taiwan) is known to occur in the Eastern realms; the other two, *F. bucerium* VAN CLEAVE, 1940 and *F. fidum* VAN CLEAVE & MANTER, 1947 occur in the Kyphosid fishes of North America. *Filisoma bucerium* has been described from *Kyphosus elegans* of Mexico and *Filisoma fidum* from *Kyphosus sectatrix* of Dry Tortugas, Florida. This indicates the stenoxenous nature of these parasite species since the Oriental species of *Filisoma* occur mainly in *Scatophagus argus* only whereas the Nearctic species are restricted to Kyphosidae and are known from *Kyphosus* species only.

2. Parafilisoma n. gen.

Generic diagnosis : Filisomatidae of medium size. Trunk elongat robust, distinctly pseudosegmented, with thick body wall and hypodermal musculature. Proboscis long, cylindrical, armed with twenty longitudinal rows of hooks of uniform size without dorso-ventral differentiation. Neck obliterated or short conical. Proboscis receptacle large, U-shaped with cerebral ganglion at its base. Lemnisci fairly long, slender, convoluted, filiform tubular, extending far beyond the proboscis receptacle posteriorly. Testes elongate, oval or ellipsoidal, tandem, pre-equatorial. Cement glands 4, fairly long, tubular, with dilated basal reservoirs. Posterior extremity of female attenuated, elongate conical. Female genital pore terminal. Parasites of Neotropical fishes.

Type species : Parafilisoma diazungriai gen. et sp. novo.

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(i) Parafilisoma diazungriai n. sp.

(Pl. XV, Fig. 115-119)

Description based on 11 specimens; 4 males, 7 females present in the Caracas Collection, No:1611. With characters of the genus as cited above. Body elongate, cylindrical, typically pseudosegmented, comprising about 60 segments in males, 70-85 in mature females. Hypodermis 0.25 mm thick with equally thick musculature. Proboscis vertical, cylindrical, armed with 20 longitudinal rows of 36-40 hooks each. Anterior hooks simple, acutely bent, posterior hooks arcuate, spiniform. No dorso-ventral differentiation in shape and size of hooks. Neck short, truncated conical. Lemnisci fairly long, narrow, tubular, convoluted, occassionally straight, extending upto the anterior testis; 1/3 the body length in females. Posterior extremity of females a elongate cone, typically set-off from the rest of the trunk.

Males : 14.5 - 25 mm long, 1.5 mm wide at maximum in the mid-body region. Proboscis 1.35 - 1.45 x 0.13 - 0.15 mm. Proboscis hooks uniform in sahpe except basal 4 of each row being arcuate spiniform. Anterior hooks 30-45 u long; roots 20-25 u in length each. Basal hooks slightly smaller, each about 25 u long with root upto 15 u in length. Neck short, basally wide. Proboscis receptacle double layered, U-shaped, 1.75 x 0.5 mm. Lemnisci extending 2.5 - 3.0 mm beyond the proboscis receptacle posteriorly.

Testes pre-equatorial, tandem, elongate oval; each 1.7 x 0.6 mm. Cement glands long tubular, 4, commencing from behind the posterior testis; total length 9.5 - 15. 5 mm in fully grown males. Seminal vesicle pyriform, 1.2 x 0.65 mm. Saefftigen's pouch large, 2.5 x 0.5 mm. Bursal cap 0.5 - 0.65 x 0.3 mm, vestibule 0.9 x 0.4 mm. Bursal rays broader, digitiform.

Females : Larger than adult males; 30.0 x 0.9 - 3.0 mm, with about 65 - 85 segments. Proboscis 1.5 mm long with 20 longitudinal rows of 40 hooks each; measurements of hooks same as in males.

Hypodermis and hypodermal musculature too thick so as to render inner details obscure. Posterior extremity set-off from the trunk, comprising a single elongate conical segment about 1.25 mm long. Female genital pore postero-terminal.

Type host : Caranx sp., - (Carangidae)

Type locality : Puerto Cabello., N. Venezuela.

Holotype male, Allotype female and various paratypes to be deposited in Museo Nacional de Historia Naturelle, Caracas, Venezuela under Accession No: 1611.

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Family Plagiorhynchidae GOLVAN, 1960

Subfamily Plagiorhynchinae MEYER, 1931.

1. Genus Plagiorhynchus LUHE, 1911, emended.

Generic diagnosis : Plagiorhynchidae; body elongate, cylindrical or fusiform. Proboscis cylindrical, subcylindrical or ovoid, usually ventrally inclined. Proboscis receptacle double-walled, inserted at the basal region of the proboscis. Neck short or obliterated. Proboscis hooks with well developed posteriad roots; in longitudinal rows rows with hooks disposed in linear pattern. Cerebral ganglion anterior to middle of the receptacle. Lemnisci long, slender, tubular. Testes oval, pre-equatorial. Cement glands 4-6, elongate, tubular, or reniform. Eggs oval with short rounded polar bulbs. Parasites of birds.

Type species : Plagiorhynchus crassicollis (VILLOT,1875).

(1) Plagiorhynchus reticulatus (WESTRUMB,1821)

Synonyms : = Echinorhynchus reticulatus WESTRUMB, 1821.
= Prosthorhynchus reticulatus TRAVASSOS, 1926 .- syn. fide SCHMIDT & KUNTZ, 1967.

(Pl. XVII, Fig. 129-131)

Material : Caracas Collection , No: 1.607 (1 male, 1 female), No: 2.968 (1 male).

Host : Squatarola s. anatum RIDGEWAY - (Scolopacidae).
Locality : La Arestinga, Nueva Esparata, Venezuela.

The genus Plagiorhynchus has been represented by six species in the Americas, two of these, namely, P. formosus VAN - CLEAVE, 1918 and P. paulus VAN CLEAVE & WILLIAMS, 1956 have been reported in North America and 4 of these, namely, P. angrensis TRAVASSOS, 1926, P. reticulatus (WESTRUMB,1821), P. longirostris (TRAVASSOS, 1926) and P. rheae (FUHRMANN,1902) are known to occur in the Neotropical region, mainly Brazil. This is, however, the first report of its occurrence in Venezuela.

Specimens available to the present author conform with the description and measurements given by TRAVASSOS (1926) for Prosthorhynchus reticulatus as well as Prosthorhynchus longirostris to a considerable extent. P. reticulatus differs from P. longirostris in having 26 longitudinal rows of 16 hooks each in the former and 20 longitudinal rows inthe latter. The present material falls within this range ; the male possesses 16 longitudinal rows of 16 hooks each whereas the females have 18 longitudinal rows of 16 hooks each. This indicates that difference of one or two rows can at best be regarded as an intra-specific variation. Moreover, the original description of P. longirostris is based on younger specimens and in that event P. longirostris would probably become a junior synonym of P. reticulatus. Until types or topotypes ofthe two are compared, it would not be proper to reduce the former to synonymy but would be safe to consider the two as sibling species, a view which can plausibly be attributed to the systematic status of the two North American species, P. formosus and P. paulus. which too are sibling if not synonymous.

Further, this report constitutes a new host and locality record of Plagiorhynchus reticulatus (WESTRUMB) whose range of distribution is now extended further northward to Venezuela.

The specimens are to be deposited with Museo Nacional de Historia Naturelle, La Salle, Caracas, Venezuela, under catalogue No: 2.968/1.

(ii) *Plagiorhynchus salubris* n. sp.

(Pl. XVI, Fig. 120-128)

Description based on 5 males and 12 female specimens with characters of the genus. Body small, plump, fusiform, ventrally curved in the middle. Cuticle thicker. Hypodermic nuclei numerous, small, oval or elliptical. Proboscis short, oval in males, slightly elongated in females, ventrally inclined in both sexes, 0.7 - 0.8 mm long. Proboscis receptacle ellipsoidal, broader in the middle with ganglion in front of its base. Neck short, proboscis receptacle inserted slightly anterior to base of presoma. Lemnisci fairly long, slender, tubular, recumbent. Female genital pore postero-terminal. Eggs elliptical; inner shell with minute polar bulges, middle shell with fibrillar ornamentation.

Male : 10.0 - 12.5 mm long, 0.9 - 1.2 mm wide in the middle, 0.6 mm in the posterior 1/3 of the trunk. Proboscis 0.7 x 0.5 mm, armed with 24 longitudinal rows of 14-16 hooks each, with their measurements as follows : (in micra for each) :

Ser. No.	Neck	Root.
I (apical)	25	20
II	45	25
III & IV	50	45
V	60	60
VI-VII	50	30
VIII-XIV	50	40
XV-XVI	40	20.

Neck short, almost attenuated and obliterated due to the ventro-terminal inclination of the proboscis. Lemnisci elongate, tubular, recumbent, sub-equal, 3.6 x 0.15 and 5.0 x 0.15 mm respectively, extending posteriorly past the anterior testis well upto the middle of the posterior one.

Testes oval or spheroidal, pre-equatorial, nearer anterior extremity of the trunk, each 1.1 - 1.25 x 0.9 mm. Cement glands 4, elongate, tubular, 5.5 mm long collectively. Seminal vesicle elongate, fusiform, 1.25 mm long. Saefftigen's pouch large, pyriform, 1.0 x 0.35 mm with duct about 1.2 mm long. Bursa everted, about 1.2 mm linear extent. Bursal flap 0.65 mm wide.

Females : similar to males in shape and size; 10.25 - 12.6 x 0.9 mm. Proboscis 0.8 x 0.6 mm. Proboscis hooks same in shape, number and size as in males. Lemnisci and distal portion of genital tract obscured by the stuffing of eggs in the pseudocoel.

Female genital pore postero-terminal. Genital sphincters tandem, each 0.3 mm wide at maximum. Vaginal bulb 0.2 x 0. 45 mm. Eggs elliptical with ellipsoidal middle shell, 70 x 30 u each; middle shell sculptured and with short rounded polar bulbs.

Type host : *Turdus serranus* (LINNEUS) - (Turdidae),
Other host: *Cyanocorax* sp.- (Cucullidae).

Type locality : El Avila, District Federal, Venezuela.
Other locality : Uruyen, Auyantepuxi, NW Venezuela.

Holotype male No: 2190, Allotype female No: 2200 and paratype series No: 2203/5 and 2.004/2 to be deposited in Museo Nacional de Historia Naturelle, La Salle, Caracas, Venezuela.

Plagiorhynchus salubris n. sp., the second plagiorhynchid species to be described from Venezuela can be distinguished from the rest of its Nearctic and Neotropical congeners in having a short, oval, subterminal ovoid proboscis and also in having a relatively larger number of proboscis hooks. In the latter respect, it, however, comes closer to *P. angrensis* (TRAVASSOS, 1926) but can be differentiated from the latter species through the shape and size of the lemnisci which are elongate, tubular and much longer than the proboscis receptacle in the former and short, digitform, almost half as long the proboscis receptacle in the latter.

Key to the New World species of Plagiorhynchus.

(1) a - Proboscis elongate, cylindrical, terminal or sub-terminal, ventrally inclined .... (2)

b - Proboscis short, oval or sub-spherical .... (5)

(2) a - Proboscis terminal and vertical .... (3)

b - Proboscis sub-terminal, ventrally inclined ...... (4)

(3) a - Proboscis hooks in 16-18 longitudinal rows of 14 hooks each .... *P. formosus*.

b - Proboscis hooks in 16-18 longitudinal rows of 20 hooks each .... *P. paulus*.

(4) a - Proboscis hooks in 16-18 longitudinal rows of 16 hooks each .... *P. reticulatus*.

b - Proboscis hooks in 20 longitudinal rows of 20 hooks each .... *P. longirostris*.

(5) a - Proboscis hooks in 24 longitudinal rows, lemnisci longer than the receptacle .... *P. salubris*.

b - Proboscis hooks in 18 longitudinal rows, lemnisci shorter or as long as the receptacle .... (6)

(6) a - Lemnisci 1/2 the length of receptacle, cement glands 4, tubular .... *P. angrensis*.

b - Lemnisci as long as the receptacle, cement glands 6, follicular .... *P. rheae*.

2. Genus Lueheia TRAVASSOS, 1919.

Generic diagnosis : Plagiorhynchinae of medium or small size with elongate fusiform trunk. Proboscis short, oval or sub-spherical, armed with 20 - 30 longitudinal rows of hooks, the medians of each row being larger. Proboscis receptacle double walled with cerebral ganglion in its middle. Lemnisci elongate, tubular, 4-6 in number. Testes tandem, contiguous or wider apart; pre-equatorial. Cement glands 4, long, tubular. Female genital pore postero-terminal. Eggs with short polar bulbs on the middle shell. Parasites of Neotropical birds.

Type species : Lueheia luehei TRAVASSOS, 1919.

(1) Lueheia mitis n. sp.

(Pl. XVI, Fig. 125-128)

Description based on 3 male and 2 female specimens present in Caracas Collection, No: 2004.

Body elongate, cylindroid, tapering at extremities. Fore-trunk moderately inclined ventrally. Cuticle and hypodermic thick. Proboscis ovoid to sub-spherical in males, ellipsoidal in females, armed with 20 longitudinal rows of 16 hooks each. Neck short, sub-cylindrical, 0.15 - 0.2 x 0.3 mm. Proboscis receptacle claviform, inserted at the base of the proboscis in the posterior 1/3 of presoma. Cerebral ganglion oval, median in position. Lemnisci 4, tubular, reaching upto the anterior testis.

Type host : *Cyanocorax violaceus* - (Cuculidae)

Type locality : Carrera El Junquito, Venezuela.

Holotype male, No: 2004/1, Allotype female, No: 2004/2 and two paratype females, No: 2.004/3 to be deposited in Museo Nacional de Historia Naturelle, La Salle, Caracas, Venezuela.

The genus *Lueheia* originally comprised only two species, *Lueheia luehei* TRAVASSOS, 1919 and *Lueheia inscripta* (WESTRUMB - 1821) TRAVASSOS, 1919 : both having been described and reported from Brazil. Later on, VAN CLEAVE & WILLIAMS (1956) described *L. boreotis* from Washington County, North America and until recently MACHADO FILHO (1967) has added the fourth species, in this genus, viz, *L. cajabambensis* from Peru. *Lueheia boreotis* has since been transferred to the genus *Pseudoluehia* SCHMIDT & KUNTZ, 1967 by the respective authors of the latter genus. With this only three species are now left in the genus *Lueheia* which now has its various species restricted to the Neotropical realm only.

Lueheia mitis, the new species, markedly differs from its congeners, *L. luehei* and *L. inscripta* in the number of proboscis hooks as well as in the number of lemnisci which are 4 in the present species (*L. mitis*) and typically 6 in the other two. In the latter respect it comes closer to *L. cajabambensis* MACHADO FILHO, but the latter appears to possess lesser number of hooks on the proboscis than what the former has on its proboscis.

Key to species of the genus Lueheia.

(1) a - Lemnisci 4 in number. .... (2)

b - Lemnisci 6 in number .... (3)

(2) a - Proboscis armed with 20 longitudinal rows of 16 hooks each .... *L. mitis*.

b - Proboscis armed with 16 longitudinal rows of 8-10 hooks each .... *L. cjabambensis*.

(3) a - Proboscis hooks in 20 longitudinal rows, lemnisci extending past the posterior testis .... *L. luehei*.

b - Proboscis hooks in 28-30 longitudinal rows, lemnisci extending upto the fore-margin of anterior testis. .... *L. inscripta*.

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Family Centrorhynchidae VAN CLEAVE, 1916, emend.
(Syn. = Centrorhynchidae GOLVAN, 1960)

Palaeacanthocephala of medium or small size. Trunk smooth, aspinose, elongate cylidrical or fusiform. Proboscis receptacle inserted half-way up into the presoma demarcating it into a (pre-insertion) proboscis and a (post-insertion) neck; the former with hooks, the latter may be spinose, may be aspinose. Proboscis hooks simple, recurved or anchor-shaped, quincuncially arranged. Anterior hooks large, broad, with larger posteraiad roots. Posterior hooks arcuate, spiniform, with short anteriad roots or with manubria. Lemnisci linguiform, fusiform or elongate tubular. Testes tandem, pre-equatorial. Cement glands 2-4; tubular, long or short. Eggs withour polar bulbs. Parasites of birds, occassionally mammals.

Type subfamily : Centrorhynchinae TRAVASSOS, 1926
Other subfamily : Porrorchinae GOLVAN, 1960.

<u>Key to subfamilies of Centrorhynchidae</u>

(a) Proboscis oval or spherical, proboscis hooks recurved or anchor-shaped, anterior hooks with posteriad roots, neck smooth, unarmed .... Porrorchinae.

(b) Proboscis oval or cylindroid, armed with broad recurved hooks with posteriad roots. Neck beset with large arcuate spiniform hooks with anteriad roots. Lemnisci fusiform. .... Centrorhynchinae.

I. Subfamily Porrorchinae GOLVAN, 1960, emend.

Centrorhynchidae : trunk long or short, elongate or fusiform. Proboscis oval or sub-spherical, armed with numerous longitudinal rows of quincuncillay arranged hooks. Proboscis hooks broad, recurved or anchor-shaped with manubriate roots. Lemnisci fusiform or elongate tubular. Neck unarmed. Pseudosegmentation distinct or indistinct. Testes contiguous or wider apart. Cement glands 4; long or short, straight or spirally twined. Parasites of birds, mainly Cucullidae; occassionally in mammals.

Type genus : Porrorchis FUKUI, 1929.

Porrorchinae was originally assigned to the family Plagiorhynchidae by GOLVAN (1960) and included the genera Porrorchis FUKUI, 1929, Pseudoporrorchis JOYEUX & BAER, 1935, Oligoterorhynchus MONTICELLI, 1914, Lueheia TRAVASSOS, 1919 and Pseudogordiorhynchus GOLVAN, 1957. YAMAGUTI (1963), however, did not accept this scheme and relegated the first two of the above mentioned genera to Prosthorhynchidae PETROCHENKO, 1956 (sic) and the remaining three to Plagiorhynchidae GOLVAN, 1960. SCHMIDT & KUNTZ (1967), in a later study, reiterated Golvan's views, re-ascribed Porrorchinae to Plagiorhynchidae, added two more genera Owilfordia SCHMIDT & KUNTZ, 1967 and Pseudolueheia SCHMIDT & KUNTZ, 1967 to the former and declared Pseudoporrorchis JOYEUX & BAER, 1935 as the junior synonym of Porrorchis FUKUI, 1929.

In the present study, for reasons discussed later, Porrorchinae is regarded as a constituent subfamily of Centrorhynchidae since its constituent taxa have much closer affininities with those of the latter and includes the genera Porrorchi, the nominate type, and Pseudolucheia, Owilfordia and a new genus, Porrorchoides. Lucheia, Oligoterorhynchus and Pseudogordiorhynchus are relegated to Plagiorhynchidae wherein they concur with thhe concepts of the family as advocated by PETROCHENKO (1958) and later by YAMAGUTI (1963). The systematic position of these taxa is is discussed later on. Presently the genera constituting the subfamily Porrorchinae are distinguished from each other through the following diagnostic key :

Key to genera of Porrorchinae

(1) a - Trunk long, cylindrical, dilated in anterior 1/4, internal pseudosegmentation distinct, cement glands 2/3 the length of trunk .... (2)

b - Trunk short, plump or fusiform, inner pseudosegmentation absent, cement glands short or moderately long ....(3)

(2) a - Hooks simple, recurved, with posteriad roots in anterior hooks and anteriad in posteriad hooks ...... Porrorchis.

b - Hooks anchor-shaped with bilateral manubria in anterior and bifid anteriad roots in posterior spiniform hooks.. .... Owilfordia.

(3) a - Trunk sigmoid, neck long cylindrical, lemnisci elongate tubular, cement glands spirally twined .... *Porrorchoides*.

b - Trunk fusiform, neck truncate conical, lemnisci fusiform, cement glands straight claviform .... *Pseudolueheia*.

1. Genus *Porrorchis* FUKUI, 1929

Syn. - *Pseudoporrorchis* JOYEUX & BAER, 1935.

Generic diagnosis : Porrorchinae ; trunk elongated, cylindrical, dilated in the anterior 1/4 of its length. Proboscis oval or spherical, with numerour longitudinal rows of hooks. Anterior hooks with longer posteriad roots, Posterior hooks spiniform with short anteriad roots. Neck broader than long. Internal pseudosegmentation distinct. Lemnisci fusiform or linguiform, moderately longer than the receptacle. Testes contiguous or wider apart. Cement glands long, tubular, straight, occupying 2/3 the length of trunk. Eggs without polar bulbs. Parasites of birds, mainly Cuculidae of the Old World.

Type species : *Porrorchis elongatus* FUKUI, 1929.

(i) *Porrorchis centropi* (PORTA, 1910)

Syn. = *Echinorhynchus centropi* PORTA, 1910
= *Pseudoporrorchis centropi*: JOYEUX & BAER, 1935
= *Pseudoporrorchis indicus* DAS, 1957, n. syn.
= *Pseudoporrorchis houdemeri* Joyeux & BAER, 1935, n. syn
= *Porrorchis houdemeri* : SCHMIDT & KUNTZ, 1967; hoc loco

New hosts : *Centropus sinensis intermedius* (HUME),
Centropus bengalensis (GMELIN), - Cucullidae;
Aquila rapax vindhyana FRANKLIN - Accipitridae

New localities : Aligarh, U.P., Sagara, Mysore State.

Numerous specimens of this species were obtained from the hosts at the localities mentioned above. The specimens not only conform with the description and measurements of *P. centropi* but also with that of *Porrorchis indicus* (DAS, 1957) which was originally differentiated from the former in having a lesser number of hooks (20 longitudinal rows of 8-9 hooks as against 20 longitudinal rows of 10-12 in *P. centropi*). A re-examination of the type specimens of *P. indicus*, extended by Prof. S.M.H. Khatib from Amravati, M.S., reveals that the number of proboscis hooks varies among the various specimens of DAS's material; perhaps the last two spiniform hooks escaped notice of the original author since the presoma of the specimens was partially invaginated in the fore-trunk which forms a circumvallate crateriform depression. In all other aspects both appear identical.

Likewise, the measurements of these two also coincide with those of Porrorchis houdemeri (JOYEUX & BAER, 1935) from C. sinensis of Tonkin (now Hanoi), Viet Nam. Porrorchis houdemeri was differentiated from the rest of its congeners through the presence of two 'sucker-like' structures on the bursa but these suckers are actually lateral projections of the muscularised bursal cap in speciemens with prolapsed bursal condition. Barring these few minor variations, there appears no significant difference on the basis of which P. houdemeri and P. indicus could be retained as different species. Consequently it is proposed that both these be regarded as junior synonyms of Porrorchis centropi (PORTA, 1910) which is perhaps the commonest and most widely distributed porrorchid of the cuculids of the Old World; its distribution extending from Senegal in the West to Viet Nam in the East.

2. Porrorchoides n. gen.

Generic diagnosis : Porrorchinae of small size. Trunk cylindroid to sigmoid, anteriorly attenuated, ventrally flexed. Hypodermis thick. Proboscis elongate oval or barrel-shaped, armed with 24 longitudinal rows of hooks. Neck distinct, cylindrical, aspinose. Anterior hooks of each row stout, recurved, with posteriad roots, posterior few hooks of each row obtuse spiniform with short anteriad roots. Cerebral ganglion anterior to middle of the proboscis receptacle. Lemnisci elongate, tubular, much longer than the proboscis receptacle. Testes oval to elliptical, tandem, widely apart, pre-equatorial. Cement glands 4, elongate, tubular, spirally twined. Eggs with uniform middle shell. Parasites of birds of Neotropical realm.

Type species : *Porrorchoides texeres* n. gen et sp.

(i) *Porrorchoides texeres* n. sp.

(Pl. XVII, Fig. 132-136)

Description based on 2 male and 2 female specimens present in Caracas Collection, No:2.636.

Male : trunk sigmoid, 9.0 mm long, 1.8 mm wide anteriorly, 1.0 mm posteriorly. Fore-trunk attenuated and slightly constricted at level of the proboscis receptacle. Proboscis 0.5 x 0.34 mm. Proboscis hooks in 24 longitudinal rows of 10 each; the anterior 6 hooks of each row larger, stout, acutely curved and with posteriad roots. The remaining 4 of each row rather straight, spiniform with attenuated anteriad roots. Measurements of hooks and spines as follows : (in micra).

S. No :	I	II	III-V	VI	VII-IX	X
Hooks :	35	45	50	40	35	30
Roots :	25	40	40	30	15	15

Neck cylindrical, 0.35 x 0.25 mm anteriorly, 0.35 mm wide posteriorly at its base. Fore-trunk narrow, attenuated. Proboscis receptacle 1.25 x 0.28 mm. Lemnisci elongate tubular, longer than the proboscis receptacle, each about 2.4 x 0.01 mm, extending past the anterior testis.

Testes oval or ellipsoidal, pre-equatorial, distantly tandem, sub-equal, anterior testis 0.8 and posterior testis 0.9 mm in diameter. Cement glands 4, short tubular, spirally twined, 0.25 mm in entire length. Saefftigen's pouch pyriform, 1.0 x 0.35 mm. Seminal vesicle elongated, fusiform, 0.6 x 0.1 mm. Bursal cap convex, 0.55 x 0.6 mm. Vestibule 1.8 mm in length.

Female : Body sigmoid, dorsally curved in middle, 9.0 - 10.5 mm long, 1.75 - 2.0 mm wide at maximum in the mid-body region. Proboscis sub-cylindrical, ventrally inclined, 0.5 x 0.35 mm. Shape and measurements of proboscis hooks same as in males. Neck 0.3 x 0.35 mm. Lemnisci 1.65 mm each. Female genital pore postero-terminal. Eggs 60 x 30 u each, without polar bulbs.on the middle shell.

Type host : Piaya cayana SHELLEY - Cucullidae.

Type locality : Cecilia Magdalena, Rio Caura, Venezuela.

Holotype male, allotype female and two paratypes to be deposited with Museo Nacional de Historia Naturelle, La Salle, Caracas, Venezuela under Accession No: 2.636.

II. Subfamily Centrorhynchinae TRAVASSOS, 1926

1. Genus *Centrorhynchus* LUHE, 1911

Generic diagnosis : Centrorhynchinae; trunk elongate, cylindrical, usually dilated in the anterior 1/4. Proboscis cylindrical, subcylindrical or elongate conical, armed with quincuncially arranged hooks with posteriad roots. Neck long, cylindroid, broader at base, beset with numerous arcuate spines with short anteriad roots. Lemnisci fusiform or claviform, shorter or longer than the proboscis receptacle. Cerebral ganglion in the mid-receptacular region. Testes oval or spherical, tandem, pre-equatorial or in the mid-body region. Cement glands 2-4, long cylindrical, tubular. Lacunar system scalaeform resulting in distinct internal pseudosegmentation. Posterior extremity of female swollen. Female genital pore sub-terminal, usually followed by a digitiform terminal appendix. Eggs with thicker middle shell without polar bulbs, occassionally with fibrillar ornamentations. Parasites of birds, chiefly raptatores, occassionally mammals.

Type species : *Centrorhynchus aluconis* (MULLER, 1780)

Marked speciation has taken place among the various members of the genus *Centrorhynchus* and occassional analyses of its species by various workers has resulted in the recognition of either subgenera (GOLVAN, 1956; DOLLFUS & GOLVAN, 1960; GOLVAN,1960) or distinct and different genera (WITENBERG, 1932, GOLVAN, 1956, 1960, 1962; TRONCY, 1969). This has been discussed in detail later.

However, in view of this trend of speciation, descriptions of the new species (as well as new host/locality records) are dealt with on zoo-geographic regional basis. The genus is fairly well represented in all the Regions and the fauna of each has distinct taxonomic peculiarities. Centrorhynchids of the Neotropical realm appear markedly distinct from their Nearctic congeners and thus constitute a distinguished biological group and some of them are represented through new species being described in the present study.

(A) Neotropical species

So far about nine species in the genus *Centrorhynchus* are known from the Neotropical realm; these are : *C. giganteus* TRAVASSOS, 1919, *C. tumidulus* (RUDOLPHI, 1819), *C. opimus* TRAVASSOS, 1919, *C. albidus* MEYER, 1932 and *C. polymorphus* TRAVASSOS, 1925 from Brazil; *C. microcephalus* MARGARITA BRAVO-HOLLIS, 1947 from Mexico and Uruguay and *C. kuntzi* SCHMIDT & NEILAND, 1966, *C. crotophagicola* SCHMIDT & NEILAND, 1966 and *C. nicaraguensis* SCHMIDT & NEILAND, 1966 from Nicagagua. *Centrorhynchus fasciatus* (WESTRUMB,1821) has since been relegated to the genus *Mediorhynchus* by YAMAGUTI (1963). Three more new species, all from Venezuela, are being described in the present study and a few reported for the first time in that country. The trend of speciation and the faunal wealth of that region indicates the possibilities of further speciation leading to many more species yet to be discovered in that Region.

(i) *Centrorhynchus giganteus* TRAVASSOS, 1919

Material : Caracas Collection, No: 2950, 2959, 2962, 2965, 2981, 2984.

Hosts : *Buteo magnirostris griseocauda* RIDGEWAY, *Buteo brachyurus* VIEILLOT - (Accipitridae), *Falco* sp.- (Falconidae) ; *Crotophaga* sp. - (Crotophagidae).

Locality : Cecilia Magdalena., Venezuela.

Several specimens, as detailed above, were contained in the Caracas Collections with corresponding numbers. The specimens conform with the description given for *C. giganteus* by TRAVASSOS (1919 & 1926). This is, however, the first record of the occurrence of this species in Venezuela and the report constitutes a new host and locality record also.

(ii) *Centrorhynchus tumidulus* (RUDOLPHI, 1819)

Material : 1 male and 2 female specimens in Caracas Collection No : 3232

Host : *Buteo* sp.- (Accipitridae)

Locality : San Juan De Manapiara., Venezuela.

This species was previously recorded from Brazil (WESTRUMB, 1821 ; TRAVASSOS, 1919, 1926), Montivideo, Uruguay (CORDERO, 1933) and Cuba (PEREZ VIGUERAS, 1936) and its larval forms have been reported in <u>Tropidonotus</u> sp. in Venezuela (DIAZ-UNGRIA : personal communication - 1962). The occurrence of its adults in <u>Buteo</u> sp., at San Juan De Manapiara is a new host and locality record. The measurements of specimens in the present collection are quite similar to those given by TRAVASSOS (1926).

<u>(iii) Centrorhynchus lepidus n. sp.</u>

(Pl. XVIII, Fig. 137-140)

Material : Caracas Collection, No: 2502 - 1 male specimen,
No: 2503 - 2 males and 1 female specimen.

With characters of the genus <u>Centrorhynchus</u> : body small, dorsally flexed, dilated in the anterior 1/3 of its length. Proboscis cylinderoid, broader in the middle. Neck elongate, wider at the base. Proboscis hooks in 32 longitudinal rows of 28 hooks (12 + 16) each. Proboscis receptacle inserted immediately behind the broader middle region of the presoma. Lemnisci massive, fusiform or claviform, longer than the proboscis receptacle. Cerebral ganglion in the mid-presomal region. Testes spherical, diagonally tandem, contained in the anterior dilated portion of the trunk. Cement glands 4, elongate, tubular. Posterior extremity of female tapering. Vaginal pore sub-terminal. Appendix absent.

Male : 11.75 mm long, 0.95 mm wide anteriorly, 0.62 mm posteriorly. Fore-trunk 3.2 x 0.95 mm. Proboscis 0.75 x 0.35 mm at its maximum width in the middle. Neck 0.65 x 0.5 mm at the base, 0.35 mm wide distally. Proboscis hooks in 32 longitudinal rows with 12 hooks on the proboscis and 16 in each row on the neck region. Apical 2 of each row 40 u long with roots 30 u each, III - VIII of each row 45 u long, roots 40 u; IX-XII of each row 40 u, roots of corresponding hooks 25 u in length, each. Neck spines arcuate, quincuncial; each 30 u long with anteriad roots about 20 u each. Proboscis receptacle 1.5 x 0.25 mm. Lemnisci 1.5 x 0.25 mm. Testes obliquely tandem, spherical, each 0.5 x 0.48 mm. Cement glands tubular, 4 ; total length 4.0 mm. Seminal vesicle 0.6 x 0.21 mm. Saefftigen's pouch 0.4 x 0.1 mm. Bursa 1.25 x 0.32 mm. Bursal cap convex, 0.4 x 0.4 mm with 10 - 12 digitiform bursal rays.

Female : (young) 13.5 x 1.2 mm anteriorly, 0.6 mm wide posteriorly. Fore-trunk 3.0 x 1.2 mm. Proboscis partly inverted distally. Proboscis receptacle 1.8 x 0.35 mm. Lemnisci thicker and basally broader than those of the males. Ovarian balls elliptical, stacked, 0.2 x 0.5 mm long each. Uterine bell 0.3 x 0.12 mm. Uterus fusiform, 0.9 mm long, 0.15 mm wide. Sphincters tandem, each about 0.1 mm in diameter. Vagina sub-terminal, 0.18 mm anterior to the tip of the posterior extremity. Appendix attenuated, almost flush with the rear end of the trunk.

Type host : Cyanocorax violaceus VIEILLOT - (Picidae)
Type locality : Rio Caura , Bolivar., Venezuela.
Holotypem male No: 2503, allotype female No: 2503/2 and paratypes in Museo Nacional de Historia Naturelle, Caracas.

Centrorhynchus lepidus, the new species appears quite distinct from the rest of its Neotropical congeners in the shape and organization of its proboscis and trunk. It, however, comes close to *C. kuntzi* SCHMIDT & KUNTZ, 1966 but differs from the latter in having spherical testes located in the anterior half of the dilated fore-trunk and in having more hooks on the proboscis and the neck. The lemnisci are more slender in *C. kuntzi* than in *C. lepidus*.

(iv) *Centrorhynchus elusis* n. sp.

(Pl. XVIII, Fig. 141-143)

Description based on two male specimens present in the Caracas Collection, No: 3.145.
Body elongate, slender, 17.6 - 18.00 mm long, 0.8 mm wide anteriorly and 0, 45 mm posteriorly. Fore-trunk dilated, haunched anteriorly, 1.8 x 0.8 mm. Proboscis claviform, posteriorly swollen, 0.5x0.29 mm. Neck conical, 0.3 x 0.25 mm distally, 0.37 mm wide proximally. Proboscis hooks in 32 longitudinal rows of 24 (8+4+12) each. Anterior (apical hooks) 30 u long, roots also 30 u in length. Next 4 hooks of each row 40 u each with roots about 30 u each. Hook IX - XII also 40 u each but with larger peeriad roots. Neck spines arcuate, with attenuated roots, each 30 u and 10 u in length respectively. Proboscis receptacle 1.27 x 0.25 mm. Cerebral ganglion in posterior 1/4 of the proboscis receptacle. Lemnisci fusiform, moderately longer than the proboscis receptacle, each

about 1.2 x 0.3 mm in length.

Testes elongate elliptical, pre-equatorial, tandem, slightly wide apart, both situated beyond the dilated portion of the fore-trunk; each 0.8 x 0.35 mm. Cement glands 4, elongate, tubular, total length 9.0 mm. Seminal vesicle 1.2 x 0.3 mm. Saefftigen's pouch 0.75 x 0.3 mm. Bursa 1.6 x 0.55 mm. Bursal cap 0.5 x 0.5 mm with 12 - 16 short digitiform bursal rays.

Female : not known.

Type host : Buteo albicaudatus VIEILLOT - (Accipitridae).
Type locality : Mara Zulia, D.F. Central, Venezuela.
Type specimens : Holotype male No: 3.145 , Paratype male No: 3.245/1 to be deposited in Meseo Nacinal de Historia Naturelle, La Salle, Caracas, Venezuela.

Centrorhynchus olunis n. sp. markedly differs from the already known New World species of the genus Centrorhynchus in the general appearance of the trunk which is typically haunche-backed in the anterior (fore-trunk) region, in the position of the testes and also size and number of proboscis hooks.

(v) Centrorhynchus venezuelensis n. sp.

(Pl. XVIII, Fig. 144,145)
(Pl. XIX., Fig. 146- 150)

Material : 1 male and 2 female specimens in Caracas Collection No: 1098 ; 2 immature male specimens in Caracas Collection No. 3361.

With characters of the genus Centrorhynchus : trunk slender anterior 1/5 slightly wider than the uniformly cylindrical 4/5 of its length. Proboscis cylindrical, tapering anteriorly. Proboscis hooks in 32 longitudinal rows of 32 hooks each. Proboscis receptacle inserted a short distance up in the presoma. Neck relatively short with shorter arcuate spiniform hooks. Lemnisci digitiform, half as long as the proboscis receptacle. Cement glands 2; elongate, tubular. Female genital pore ventro-terminal. Terminal appendix attenuated.

Male : 12.0 x 0.8 mm wide anteriorly, 0.5 mm posteriorly. Fore-trunk 2.2 x 0.8 mm. Proboscis wedge-shaped, 0.6 x 0.25 mm. Neck uniform in width, 0.2 x 0.2 mm. Proboscis hooks in 32 longitudinal rows of 32 (12 + 20) hooks each. Anterior hooks 30 - 36 u long with roots 30 u each in the anterior 4 and 36 u each in the next 8 hooks of each row. Neck spines relatively short, acute, each about 20 u in length with short, attenuated anteriad roots gradually decresing from 15 to 10 u in length vertically. Proboscis receptacle 1.5 x 0.2 mm. Lemnisci short, each about 0.6 mm long, 0.1 mm wide.

Testes spherical, tandem, pre-equatorial, nearer anterior extremity of the trunk, situated within the wider fore-trunk, each 0.4 mm in diameter. Cement glands 2, elongate, tubular, compact, together about 6.2 mm long. Seminal vesicle pyriform, 0.7 x 0.3 mm. Saefftigen's pouch 0.4 x 0.2 mm. Bursa 0.6 x 0.3 mm with about 16 digitiform bursal rays.

Female : Trunk usually coiled, 15.0 mm long, 0.95 mm wide anteriorly, 0.75 mm posteriorly. Proboscis 0.56 - 0.65 x 0.25 mm. Neck 0.3 - 0.35 x 0.2 - 0.3 mm. Shape, number and size of hooks same as in males. Proboscis receptacle 1.6 - 2.2 x 0.25 mm. Cerebral ganglion in the mid-receptacular region. Lemnisci 0.67 mm long, o.1 mm wide each.

Uterine bell 0.1 x 0.08 mm. Uterus 0.25 x 0.1 mm. Female genital pore sub-terminal. Sphincters tandem, 70 u and 45 u in maximum width respectively. Terminal appendix short, about 100 u long. Eggs 30 x 15 u each.

Type host : Buteo magnirostris SWINHOE - (Accipitridae)
Type locality : Atures, D.F. Amazones., Venezuela.
Holotype male No: 1098/1, allotype female No: 1098/2 in Museo Nacinal de Historia Naturelle, La Salle, Caracas, Venezuela; paratypes (immature males) No:3361/1 in Zoological Museum, AMU, Aligarh.

Key to Neotropical species of Centrorhynchus.

(1) a - Body short, trunk fusiform, proboscis claviform ..... (2)

b - Body long, trunk elongated, cylindrical, anteriorly swollen and set off or not, proboscis elongate conical or claviform, wider in the middle .... (3)

(2) a - Proboscis armed with 24 longitudinal rows of 12 hooks each .... *C. opimus*.

b - Proboscis armed with 30 longitudinal rows of 10 hooks each .... *C. polymorphus*.

(3) a - Proboscis elongated conical; fore-trunk uniformly tapering or swollen and set off .... (4)

b - Proboscis claviform, wide in the middle; fore-trunk distinctly set off .... (8)

(4) a - Fore-trunk tapering uniformly................ (5)

b - Fore-trunk swollen, set off .... (6)

(5) a - Proboscis with 22 - 24 longitudinal rows of 28 hooks each; 4 cement glands; lemnici longer than the proboscis receptacle .... *C. giganteus*.

b - Proboscis with 26 longitudinal rows of 20 hooks each; lemnisci not extending beyond the proboscis - receptacle; 4 cement glands .... *C. tumidulus*.

c - Proboscis with 35 longitudinal rows of 17 hooks each; lemnisci longer; 3 cement glands ....C.... .... *C. crotophagicola*.

(6) a - Neck short with few spines in each longitudinal row; lemnisci half as long as the proboscis - receptacle; 2 cement glands .... C. *venezuelensis*.

b - Neck lon with relatively more hooks; lemnisci twice the length of proboscis receptacle; 4 cement glands in males .... (7)

(7) a - Proboscis with 30 longitudinal rows of hooks; 22 in each row; 3 cement glands .... C. *albidus*.

b - Proboscis with 30 - 35 longitudinal rows of 24 hooks each; 12 spiniform hooks on the neck .... C. *kuntzi*.

c - Proboscis with 40 longitudinal rows of 17 hooks each ; cement glands (?) .... C. *nicaraguensis*.

(8) a - Trunk uniformly tapering anteriorly and posteriorly; neck short, basally broad; 3 cement glands .... C. *microcephalus*.

b - Trunk swollen, set off; neck longer or as long as the proboscis receptacle .... (9)

(9) a - Fore-trunk 1/3 total body length; lemnisci twice the length of receptacle; testes spherical, obliquely tandem; within fore-trunk .... C. *lepidus*.

(9) b - Fore-trunk much shorter; cluniform dextrally; neck short and wide proximally; lemnisci as long as proboscis receptacle; testes elliptical, tandem; wide apart; beyond the swollen fore-trunk region; 4 cement glands .... C. clunis.

(B) ORIENTAL SPECIES

(vi) *Centrorhynchus pseudibicola* n. sp.

(Pl. XIX, Fig. 151-153)

Description based on 3 male specimens with characters of the genus. Body elongate, slender, broad and fusiform anteriorly and narrow, tapering posteriorly; 15.0 - 16.5 mm long, 1.75 mm wide anteriorly, 1.0 mm elsewhere. Fore-trunk swollen, 4.5 x 1.75 mm. Proboscis elongate conical, slightly constricted in the middle at the level of the insertion of proboscis receptacle; 0.7 mm long, 0.32 mm wide anteriorly at the apex, 0.25 mm in the middle at the level of the constriction. Neck broad conical, wider at base; 0.4 mm long, 0.3 mm wide distally, 0.45 mm proximally.

Proboscis hooks in 40 longitudinal rows of 30 - 32 each. Anterior hooks broad, stout with large posteriad roots; posterior hooks situated on the neck arcuate, spiniform with attenuated anteriad roots. Apicals (I & II) of each row 35 long with trapezoid roots, each about 25 u in length; III - VI of each row

40 u long with roots 25 - 35 u in length for each; VII - X of each row relatively smaller, 25 - 28 u long with roots 28-30 u in length posteriorly. Remaining two hooks of each row, i.e XI & XII transitional ; each about 25 u long, roots antero-posteriad, upto 15 in length vertically. Neck spines quincuncially arranged, delicate; each about 20 u long with short anteriad roots, 10 u long.

Proboscis receptacle 1.3 x 0.32 mm with cerebral ganglion in the middle. Lemnisci elongate fusiform, longer than the proboscis receptacle; each 1.75 x 0.25 mm.

Testes oval, tandem, pre-equatorial, in the middle of the fore-trunk, 0.65 x 0.4 mm each. Cement glands 4, elongate tubular, slender, 6.0 x 0.3 mm. Seminal vesicle 1.8 x 0.3 mm. Bursa convex anteriorly, bursal cap 0.5 x 0.6 mm. Vestibule 1.5 mm long with 10-12 short digitiform bursal rays.

Female : not known.

Type host : Pseudibis papillosa (TEMMINCK) - Threskiornithidae
Type locality : Aligarh, U.P.
Holotype male and 2 paratypes deposited in the Zoological Museum, AMU, Aligarh

Centrorhynchus pseudibicola n. sp. comes close to C. milvus WARD, 1956 but can be differentiated from the latter in the size of the proboscis and lemnisci and also in the number of proboscis hooks. The fore-trunk is narrower in the latter than in the former.

(vii) Centrorhynchus ophionis n. sp.

(Pl. XX, Fig. 154-159)

Numerous specimens of this species were obtained from the type host on various occassions. Measurements are based on the holotype male and the allàtype female.

Description based on the holotype male and allotype female with characters of the genus and with marked sexual dimorphism. Body elongate, slender, broader in the anterior 1/3 - 1/5 of the trunk with uniform diameter elsewhere and distinct internal pseudosegmentation. Proboscis claviform in males, slightly larger and anteriorly swollen in females. Presomal apex narrower, spheroidal or cylindroid in females. Proboscis broader at the insertion level. Neck profusely spinose, narrow anteriorly and broader proximally particularly in females. Proboscis armed with stout recurved hooks with large posteriad roots in the anterior half, with attenuated roots in the posterior half. Neck spines large, arcuate, with short anteriad roots. Presomal hooks in 40 longitudinal rows of 32 (4 + 4 + 4-6 preinsertion, 12 post-insertion) hooks each, with measurements as given below :

S.No:	I	II,III	IV	V	VI-VIII	Neck spines
Hooks:	45	50	60	50	40-45	45 : u
Roots:	30	45	65	45	15	10 : u

Proboscis receptacle inserted immediately posterior to the broader region of the proboscis with cerebral ganglion in the anterior middle region of the former. Lemnisci fusiform, twice longer than the receptacle.

Male : 14.0 - 16.0 x 0.75 mm. Fore-trunk swollen, 3.5 mm long, 0.85 mm wide; remaining cylindrical, 0.4 mm mm across. Presoma 0.9 mm long, 0.25 mm wide at the apex, 0.35 mm in the middle, 0.36 mm at the base. Proboscis 0.45 - 0.48 x 0.25 mm, 0.35 mm in width in the broader proximal region. Neck 0.57 x 0.35 mm. Proboscis receptacle 1.5 x 0.3 mm. Lemnisci fusiform, each 2.0 x 0.2 mm.

Testes elliptical, distantly tandem, 0.6 x 0.3 mm each. Cement glands 2, elongated, tubular, 7.5 mm in entire length. Seminal vesicle 1.5 x 0.15 mm. Bursa 1.5 x 0.3 mm. Bursal cap 0.5 x 0.3 mm with 12 - 16 short digitiform bursal rays.

Female : Fairly long, serpentiform, 40.0 - 45.0 mm in length, 1.3 mm wide anteriorly, 0.6 mm posteriorly. Fore-trunk broader, fusiform, 5.5 x 1.35 mm. Presoma 1.2 x 0.5 mm anteriorly, 0.62 mm wide posteriorly at the basal region. Proboscis hooks in 40 logitudinal rows of 32 each; size and shape of hooks same as in males except that the IV & V of each row 70 u long. Lemnisci fusiform, slightly larger than in males. Pseudosegmentation distinct; ovarian balls disposed metamerically within the lacunar commissures. Lacunar system typically scalaeform. Posterior extremity swollen, 0.7 mm wide. Uterine bell deep, U-shaped, 0.3 x 0.1 mm.

Uterus fusiform, with thick muscularc wall; 1.0 x 0.1 mm. Sphincters tandem, anterior 150 u wide, posterior one 100 u across. Vaginal pore subterminal. Sub-vaginal appendix 0.15 x 0.075 mm. Eggs 45 x 20 u each; middle shell thicker, without any ornamentation.

Type host : Athene brama TEMMINCK - (Accipitridae)
Type locality : Aligarh, u.p.
Holotype male, allotype female and numerous paratypes in Zoological Museum, AMU, Aligarh.

Centrorhynchus ophionis n. sp. comes closer to C. aluconis and C. clitorideus (MEYER, 1931) in some anatomical features but can be distinguished from them in having only 2 cement glnads in the males and also in the number and arrangement of the proboscis hooks.

(viii) Centrorhynchus spilornae SCHMIDT & KUNTZ, 1969

Host : Spilornis cheela (LATHAM) - Accipitridae
New locality : Aligarh, India.

Four specimens, 2 males and 2 gravid females of this species, originally described by SCHMIDT & KUNTZ (1969) from S. cheela in Taiwan were recovered from the same host, the tawny eagle, at Aligarh, during the winter of 1970. The specimens and their measurements conform with the original one. The present report constitutes new distribution record of the parasite.

(ix) Centrorhynchus knowlesi DATTA & SOOTA, 1955

Syn. = Centrorhynchus bengalensis DATTA & SOOTA, 1955 : n. syn.

New Hosts : Upupa epops longirostris JERDON - (Upupidae), Halcyon smyrnensis perpulchra von MADARASZ - (Alcedinidae).

Locality : Aligarh, U.P.

Centrorhynchus knowlesi DATTA & SOOTA, 1955 was originally described from Otus sp. (Strigidae) in Calcutta. Upupa epops longirostris and Halcyon smyrnensis perpulchra are its new hosts. The specimens abotained from these hosts were compared with the types of C. knowelsi (ZSI Collection No: W 3830/1 : Holtype male and allotype female on the same slide) and also of the other closely resembling species, C. bengalensis DATTA & SOOTA, 1955 (ZSI Collection No: W 3831/1 : Holotype male and allotype female on the same slide), originally described from Dinopium sp. in Alipore Zoo, Calcutta and all three, i.e. C. knowlesi, C. bengalensis and those in the present collection were found to be identical. Consequently they are considered as conspecific with other and, therefore, C. bengalensis is reduced as a junior synonym of Centrorhynchus knowlesi DATTA & SOOTA, 1955; the latter species being retained as valid and senior synonym by virtue of page precedence since both are described in the same publication.

(x) *Centrorhynchus robustus* (DATTA, 1928) n. comb.

Syn. = *Echinorhynchus robustus* DATTA, 1928

= *Centrorhynchus corvi* FUKUI, 1929 , n. syn.

= *Centrorhynchus turdi* YAMAGUTI, 1939, n. syn.

= *Sphaerirostris turdi* : GOLVAN, 1960

= *Centrorhynchus splendi* GUPTA & GUPTA, 1970, n. syn.

Hosts: *Corvus frugilegus* LINNEUS, *C. splendens* VIEILLOT, *Corvus macrorhynchos* WAGLER - (Corvidae)

Locality : Aligarh, U.P.

Centrorhynchus robustus (DATTA, 1928) commonly occurs in the Corvidae of of Oriental region. The species was originally assigned to the genus *Echinorhynchus* but for obvious reasons it is now being assigned to *Centrorhynchus* where it exactly belongs.

Comparison of the present material with the type specimens of *Centrorhynchus corvi*, kindly presented by TAMAO FUKUI, and other specimens forwarded by SATURO KAMEGAI of Meguro Parasitological Museum, Tokyo, enables the present author to conclude the identity of DATTA's species with *C. corvi* FUKUI, 1929; the latter thus becoming a junior synonym of the former. *C. turdi* YAMAGUTI also falls within the same range of measurements, hook formula, general shape of the body and organization of the presoma as found in the specimens recovered from the crows of this region. Consequently *C. turdi* is also regarded as a junior synonym of *Centrorhynchus robustus* (DATTA, 1928).

Centrorhynchus splendi, another closely resembling species, recently described by GUPTA & GUPTA (1970) from *Corvus splendens* of Chandigarh, Panjab, offers nothing to distinguish it from the material presently identified as *C. robustus* (DATTA, 1928). Consequently *C. splendi* GUPTA & GUPTA, 1970 is also regarded as a junior synonym of *C. robustus*.

GOLVAN (1956) has considered *C. corvi* FUKUI a synonym of *Centrorhynchus pinguis* VAN CLEAVE, 1916 but the present author is not willing to share this view since the two species present sufficient contrast between them though both have the same range of geographical distribution and utilize Corvidae as well as Turdidae as their final hosts ; *C. corvi*, henceforth a synonym of *C. robustus* occurs mainly in Corvidae (*Corvus*, *Pica*, etc) whereas *C. pinguis* is a common parasite of the Turdidae and Sturnidae of the Palaearctic and Oriental reagions (vide infra).

(xi) Centrorhynchus pinguis VAN CLEAVE, 1916.

Syn. = *Sphaerirostris pinguis* : GOLVAN, 1960
= *Centrorhynchus brevicanthus* DAS, 1950, syn. hoc loco.

Hosts : *Turdoides turdoides sommervilli* - (Turdidae).
Temenuchus pagodarum (GMELIN) - Icteridae.
Acridotheres tristis (LINNEUS) - Sturnidae.

New localities : Aligarh, U.P., Sagara, Shimoga, Mysore State., Jodhpur, Rajasthan., Kathmandu, Nepal.

Centrorhynchus pinguis is a common parasite of the Turdidae and Sturnidae of Palaearctic and Oriental realms. It was originally described by VAN CLEAVE (1916) from Pica pica sericia of Peking, China but the description was based on a single immature female specimen. Later on, SUBRAHMANIAN (1927) described the male of this species from Acridotheris tristis of Rangoon, Burma.

DAS (1950) has described another closely resembling species, Centrorhynchus brevicanthus from Temenuchus pagodarum of Nagpur. The measurements of C. brevicanthus, also described on the basis of a single female specimen, fall within the biometric range of C. pinguis and does not present any significant contrast which may substantiate the validity of DAS's species. Consequently the writer has little hesitation in considering C. brevicanthus - DAS, 1950 a junior synonym of Centrorhynchus pinguis VAN CLEAVE which enjoys a distribution as wide as that of C. robustus (= C. corvi) in the Old World.

Phylogenetically both species seem to have evolved from a common stock which has given rise to the 'lancea' group comprising C. lancea (WESTRUMB, 1821), C. [illegible] SOLOVIEW, 1912, C. narcissae FLORESCU, 1942, C. olssoni LUNDSTROM, 1942 and C. scanensis LUNDSTROM, 1942 in NW Palaearctic and to 'pinguis' group compring C. pinguis VAN CLEAVE, 1916, C. lanceoides PETROCHENKO, 1949, C. maryasis DATTA, 1933, C. hardi (YAMAGUTI, 1939), and C. sarri (DATTA, 1928) of South and Central Asia including the Oriental realm.

(V)

Discussion
on
the Systematics of Eoacanthocephala and Palaeacanthocephala.

(A) The Systematics in retrospect.

The basic concepts on which the systematics of Acanthocephala is based were founded by HAMANN (1892) who was the first to classify this group into three monotypic families, viz. Neorhynchidae (sic), Echinorhynchidae and Gigantorhynchidae which included the genera Neoechinorhynchus (originally named as Neorhynchus), Echinorhynchus and Gigantorhynchus respectively; the first and the third of each of these categories being of his own creation whereas Echinorhynchidae was proposed still earlier by COBBOLD (1879) to accommodate the genus Echinorhynchus ZOEGA in MULLER, 1776 which had at that time included all the then known acanthocephalan species. Acanthocephalus KOELREUTHER, 1771, the foremost known acanthocephalan genus, however, remained in oblivion till late in the 19th century since neither COBBOLD (1879) nor HAMANN (1891, 1892) made any reference to it anywhere in their contributions.

Further expansion in the taxonomy of this group took place towards the end of the first quarter of the present century and many new genera, species and supra-generic categories were established by various workers, notable among them being SHIPLEY (1897,1899,1900), MONTICELLI (1900,1905,1914), LINSTOW (1901,1902, 1908), PORTA (1904,1905,1908,1910), LUHE (1905,1911,1912), and

KOSTYLEW (1912, 1916,1924) from Europe, LINTON (1905,1908,1912), H.B. WARD (1910,1917) and VAN CLEAVE (1913,1916,1920,1923,1924) from North America and TRAVASSOS (1915,1916,1920,1923,1924) from South America. Thus by the end of the year 1924, eight families, four subfamilies and 33 genera were recognised in this group.

This expansion, therefore, necessitated the creation of higher taxonomic categories and the formulation of a comprehensive 'System' and this was initiated by SOUTHWELL & MACFIE (1925) who proposed the first Ordinal scheme comprising three suborders, differentiated from each other principally on the basis of the form and nature of cement glands and secondarily the shape and nature of the proboscis, particularly its retractibility or non-retractibilty within the proboscis receptacle. Their scheme accordingly included the following :

Order Acanthocephala

Suborder (I)	Neoechinorhynchidea SOUTHWELL & MACFIE, 1925
Family (1)	Neoechinorhynchidae VAN CLEAVE, 1919 (sic)
Family (2)	Quadrigyridae VAN CLEAVE, 1920
Family (3)	Apororhynchidae SHIPLEY, 1900 (sic)
Suborder (II)	Gigantorhynchidea SOUTHWELL & MACFIE, 1925
Family (1)	Gigantorhynchidae HAMANN, 1892
Family (2)	Oligacanthorhynchidae SOUTHWELL & MACFIE, 1925
Suborder (III)	Echinorhynchidea SOUTHWELL & MACFIE, 1925
Family (1)	Rhadinorhynchidae TRAVASSOS, 1923.

Family (2) Centrorhynchidae VAN CLEAVE, 1916

Family (3) Corynosomidae SOUTHWELL AND MACFIE, 1925

Family (4) Moniliformidae VAN CLEAVE, 1924

Family (5) Echinorhynchidae COBBOLD, 1879.

The above mentioned scheme was essentially founded on Hamann's since the three subordinal categories which Southwell and Macfie had proposed were actually upgradations of the three families which Hamann had earlier proposed. Being the first comprehensive of its kind it should have served as an efficient tool of classification but for certain discrepancies like the inclusion of the families Apororhynchidae and Moniliformidae under the suborders Neoechinorhynchidea and Echinorhynchidea respectively, the System warranted further emendment.

This was done by TRAVASSOS (1926) who proposed another scheme which was was essentially an elaborate version of Hamann's Ssyetm. Travassos did not recognise the suborders which Southwell and Macfie had proposed, instead he maintained four families in the group, viz. Neoechinorhynchidae, Echinorhynchidae, Gigantorhynchidae and Rhadinorhynchidae. TRAVASSOS's (1926) scheme was as follows :

Family (A) Neoechinorhynchidae TRAVASSOS, 1917 (sic)

Subfamily (1) Neoechinorhynchinae TRAVASSOS, 1926

Subfamily (2) Quadrgyrinae (VAN CLEAVE, 1920)

Family	(B)	Echinorhynchidae COBBOLD, 1879
Subfamily	(1)	Echinorhynchinae TRAVASSOS, 1919
Subfamily	(2)	Centrorhynchinae (VAN CLEAVE, 1916)
Family	(C)	Rhadinorhynchidae TRAVASSOS, 1923
Family	(D)	Gigantorhynchidae HAMANN, 1892
Subfamily	(1)	Gigantorhynchinae TRAVASSOS, 1915
Subfamily	(2)	Moniliforminae (VAN CLEAVE, 1924)
Subfamily	(3)	Prosthenorchinae TRAVASSOS, 1915.

A notable omission in this scheme, however, was the family Apororhynchidae as well as the genus Apororhynchus since neither the former nor the latter happen to appear anywhere in this scheme otherwiseit was a natural and more acceptable an scheme except that Travassos's action of suppressing the families Quadrigyridae, Centrorhynchidae and Moniliformidae to subfamily ranks was rather unwarranted and somewhat contradictory to the basic criteria which he (TRAVASSOS, 1926) had utilised in the characterization of the four familial categories.

In 1927 THAPAR proposed another ordinal scheme which too was orientated towards Southwell and Macfie's System. In establishing familial and supra-familial categories THAPAR (1927) recognised the form and nature of the roots of proboscis hooks and the presence or absence of trunk spines as principal criteria for distinguishing the various higher categories from each other. Thus he recognised three Orders in Acanthocephala of which he proposed two as new. The System as formed by THAPAR was as follows:

Order I : Echinorhynchidea SOUTHWELL & MACFIE, 1925
Family (1) : Echinorhynchidae COBBOLD, 1879
Family (2) : Oligacanthorhynchidae SOUTHWELL & MACFIE, 1925

Order II : Acanthogyridea THAPAR, 1927
Family (1) : Acanthogyridae THAPAR, 1927
Family (2) : Gigantorhynchidae HAMANN, 1892

Order III : Apororhynchidea THAPAR, 1927
Family (1) : Apororhynchidae SHIPLEY, 1900.

As is evident from the above scheme and from its details elsewhere, it was an inharmonius assemblage of various genera , irrespective of their morphological similarities and phylogenetic affinities, and likewise of the various families under their respective ordinal groups. The inclusion of Oligacanthorhynchidae under Echinorhynchidea and of Gigantorhynchidae under Acanthogyridea is contrary to the basic concepts of acanthocephalan taxonomy and render the entire scheme untenable. Further, the inclusion of the genera Moniliformis, Neoechinorhynchus and a few more neoacanthocephalan genera under Echinorhynchidae and of Centrorhynchus, Mediorhynchus, Quadrigyrus, Bolbosoma, Filicollis, Empodius and the others as well expose the limitations of this scheme which obviously could hardly sustain the further proliferation of acanthcephalan taxonomy. Consequently the System was short-lived and did not enjoy approval of subsequent workers.

In 1931 ANTON MEYER presented another ordinal scheme which he based on more comprehensive morphological and phylogenetic considerations by giving weight to the spatial position of the longitudinal lacunar vessels, presence or absence of trunk spines, organization of the proboscis and its receptacle, nature of the cement glands, persistence or intermittence of ligament sacs in females, presence or absence of protonephridea and also the nature of egg-shells. None of the previous workers had taken so many factors into account while devising their respective systems nor had any of them ascribed significance to life-cycle patterns and host-parasite relationship in the taxonomy of this group as had Meyer done. He essentially recognised two distinct Orders, Palaeacanthocephala and Archiacanthocephala, together comprising 58 genera and 12 families; six each.

MEYER (1932) revised his System later when it appeared in his treatise KLASSEN und ORDNUNGEN des TIERREICHS - Acanthocephala in the following sequence :

<u>I. Order Palaeacanthocephala MEYER, 1931</u>

Family (i) Acanthogyridae MEYER, 1931 (sic)
Genus (i) <u>Acanthogyrus</u> THAPAR, 1927
Genus (ii) <u>Farzandia</u> THAPAR, 1931

Family (2) Quadrigyridae VAN CLEAVE, 1920
Genus (i) <u>Quadrigyrus</u> VAN CLEAVE, 1920
Genus (ii) <u>Pallisentis</u> VAN CLEAVE, 1928

Genus (iii) <u>Acanthosentis</u> VERMA & DATTA, 1929

Genus (iv) <u>Neosentis</u> VAN CLEAVE, 1928

Genus (vii) <u>Heterosentis</u> VAN CLEAVE, 1931

Family (3) Rhadinorhynchidae TRAVASSOS, 1923

Genus (i) <u>Serrasentis</u> VAN CLEAVE, 1923

Genus (ii) <u>Telosentis</u> VAN CLEAVE, 1923

Genus (iii) <u>Tegorhynchus</u> VAN CLEAVE, 1920

Genus (iv) <u>Aspersentis</u> VAN CLEAVE, 1929

Genus (v) <u>Rhadinorhynchus</u> LUHE, 1911

Genus (vi) <u>Cleaveius</u> SUBRAHMANIAN, 1927

Genus (viii) <u>Leptorhynchoides</u> KOSTYLEW, 1924

Genus (ix) <u>Polyacanthorhynchus</u> TRAVASSOS, 1918

Genus (x) <u>Filisoma</u> VAN CLEAVE, 1928

Family (4) Polymorphidae MEYER, 1931

Subfamily (a) Polymorphinae MEYER, 1931

Genus (i) <u>Polymorphus</u> LUHE, 1911

Genus (ii) <u>Profilicollis</u> MEYER, 1931

Genus (iii) <u>Filicollis</u> LUHE, 1911

Genus (iv) <u>Corynosoma</u> LUHE, 1905

Genus (v) <u>Bolbosoma</u> PORTA, 1908

Genus (vi) <u>Arhythmorhynchus</u> LUHE, 1911

Subfamily (b) Centrorhynchinae MEYER, 1931

Genus (i) <u>Centrorhynchus</u> LUHE, 1911

Genus (ii) <u>Gordiorhynchus</u> MEYER, 1931

Subfamily	(c)	Plagirhynchinae MEYER, 1931
Genus	(i)	Plagiorhynchus LUHE, 1911
Genus	(ii)	Prosthorhynchus KOSTYLEW, 1915
Genus	(iii)	Oligoterorhynchus MONTICELLI, 1914
Genus	(iv)	Sphaerechinorhynchus JOHNSTON, 1929
Genus	(v)	Lueheia TRAVASSOS, 1919
Family	(5)	Fessisentidae VAN CLEAVE, 1931
Genus	(i)	Fessisentis VAN CLEAVE, 1931
Family	(6)	Echinorhynchidae COBBOLD, 1879
Subfamily	(a)	Echinorhynchinae MEYER, 1931
Genus	(i)	Acanthocephaloides MEYER, 1932
Genus	(ii)	Acanthocephalus KOELREUTHER, 1771
Genus	(iii)	Echinorhynchus MULLER, 1776
Subfamily	(b)	Cavisominae MEYER, 1932
Genus	(i)	Cavisoma VAN CLEAVE, 1931
Subfamily	(c)	Pomphorhynchinae MEYER, 1931
Genus	(i)	Pomphorhynchus MONTICELLI, 1905

II. Order Archiacanthocephala MEYER, 1931

Family	(i)	Neoechinorhynchidae VAN CLEAVE, 1919
Genus	(i)	Neoechinorhynchus HAMANN, 1892 (sic)
Genus	(ii)	Pandosentis VAN CLEAVE, 1920
Genus	(iii)	Tanaorhamphus WARD, 1918
Genus	(iv)	Gracilisentis VAN CLEAVE, 1919
Genus	(v)	Octospinifer VAN CLEAVE, 1919
Genus	(vi)	Hebesoma VAN CLEAVE, 1928
Genus	(vii)	Eosentis VAN CLEAVE, 1928

Family (2) Apororhynchidae SHIPLEY, 1899; emend.

Genus (i) Apororhynchus SHIPLEY, 1897

Family (3) Gigantorhynchidae HAMANN, 1892

Genus (i) Empodius TRAVASSOS, 1925

Genus (ii) Mediorhynchus VAN CLEAVE, 1916

Genus (iii) Gigantorhynchus HAMANN, 1892

Family (4) Oligacanthorhynchidae MEYER, 1931

Genus (i) Oligacanthorhynchus TRAVASSOS, 1915

Genus (ii) Nephridiorhynchus MEYER, 1931

Genus (iii) Nephridiacanthus MEYER, 1931

Genus (iv) Travassosia MEYER, 1932

Genus (v) Hamanniella TRAVASSOS, 1915

Genus (vi) Prosthenorchis TRAVASSOS, 1915

Genus (vii) Macracanthorhynchus TRAVASSOS, 1917

Family (5) Moniliformidae VAN CLEAVE, 1924

Genus (i) Moniliformis TRAVASSOS, 1915

Family (6) Pachysentidae MEYER, 1931

Genus (i) Pachysentis MEYER, 1931

Genus (ii) Oncicola TRAVASSOS, 1916

Genus (iii) Echinopardalis TRAVASSOS, 1918.

By far the above mentioned System was the most accomplished one and it eventually became the foundation of the modern taxonomy of Acanthocephala since it has been accepted and followed by a majority of the taxonomists in recent years and in its taxonomic philosophy it can be equated with that of SOUTHWELL & MACFIE (1925) which had evolved from HAMANN'S concise scheme. But it radically differed from those earlier proposed by other authors not only in basic concepts but also in contents. The Orders Acanthogyridea and Apororhynchidea were altogether deleted and the constituent genera, viz. Acanthogyrus and Apororhynchus were assigned to Palaeacanthocephala and Archiacanthocephala respectively. Similarly the inclusion of Neoechinorhynchidae under the latter Order was incompatible with the basic concept of ordinal organization of the group. MEYER (1931, 1932), however, much emphasised on the dichotomy of the acanthocephalan organization (VAN CLEAVE, 1953) and thereby omitted one of the most consistent and taxonomically significant character (which has often been 'overemphasised' by some authors though) - the single syncytial or multiple follicular nature of the cement glands in males. The single or double layered nature of the proboscis receptacle and structure of the egg being the other two characters which have been either omitted in ceratin cases or mixed up in others by MEYER (1931).

Inspite of the elaboration of this system, certain inconsistancies were obvious and they did necessitate further emendment. The most significant inconsistancy is the inclusion of Acanthogyridae under Palaeacanthocephala and of Neoechinorhynchidae under Archiacanthocephala since the constituent genera (and species) of these two families have closer affinities with each other than with the Ordinal groups to which they were assigned to be MEYER.

It, therefore, becomes obvious, more so from the present standards and criteria of acanthocephalan taxonomy that the families Acanthogyridae THAPAR, 1927 (for which MEYER claims authority for himself) and Neoechinorhynchidae represent an organization distinct by itself and different from the ones each was originally assigned to by MEYER (1931, 1932). This was taken into account by VAN CLEAVE (1936) who felt the necessity of the organization of a distinct ordinal identity of such a group which was compatible neither with Palaeacanthocephala nor with Archiacanthocephala, and therefore VAN CLEAVE (1936) created the Order Eoacanthocephala to accommodate the families Acanthogyridae, Neoechinorhynchidae and also Tenuisentidae which was created to include the single genus Tenuisentis . The creation of this Order thus rationalised the taxonomy of the group better than before and was elaborated by various workers later.

WITENBERG (1932) did not reconcile his with MEYER's System and, instead, proposed another arbitrary scheme which was almost in accordance with the system of SOUTHWELL & MACFIE (1925) and of THAPAR (1927). WITENBERG (loc. cit) retained the Orders Apororhynchidea, Neoechinorhynchidea, Echinorhynchidea and Gigantorhynchidea but deleted Acanthogyridea and assigned its constituent genera to Neoechinorhynchidea. The scheme is given below :

Order	(I)	Apororhynchidea THAPAR, 1927
Family	(1)	Family Apororhynchidae SHIPLEY, 1900
Order	(II)	Echinorhynchidea SOUTHWELL & MACFIE, 1925

Family	(1)	Neoechinorhynchidae TRAVASSOS,1917 (sic)
Family	(2)	Centrorhynchidae VAN CLEAVE, 1916
Subfamily	(a)	Centrorhynchinae TRAVASSOS, 1926
Subfamily	(b)	Polymorphinae MEYER, 1931
Subfamily	(c)	Rhadinorhynchinae LUHE, 1912
Family	(3)	Echinorhynchidae COBBOLD, 1876
Subfamily	(a)	Echinorhynchinae TRAVASSOS, 1919
Subfamily	(b)	Corynosominae WITENBERG, 1932
Subfamily	(c)	Leptorhynchoidinae WITENBERG, 1932
Order	(III)	Gigantorhynchidea SOUTHWELL & MACFIE, 1925
Family	(I)	Gigantorhynchidae HAMANN, 1892
Subfamily	(a)	Prosthenorchinae TRAVASSOS, 1915
Subfamily	(b)	Gigantorhynchinae TRAVASSOS, 1915

The above System showed, however, in no way any improvent over that of MEYER's since it contained many discrepancies too. The scheme offered little justification, if any, in including Moniliformis under Echinorhynchinae, or in assigning the subfamilies Rhadinorhynchinae and Corynosominae (sic) under Centrorhynchidae and Echinorhynchidae respectively , or the merger of Pachysentidae and Oligacanthorhynchidae with Gigantorhynchidae under whom they are totally untenable. Witenberg's was almost an artificial scheme, mostly subjective in nature, and that is probably the main reason that precluded its recognition by subsequent workers.

The next significant contribution to acanthocephalan taxonomy was made by VAN CLEAVE (1936) who elaborated Meyer's scheme by proposing the third Order - the Eoacanthocephala, to accommodate those families which were otherwise untenable within Palaeacanthocephala and Archiacanthocephala. Eoacanthocephala was further divided into two suborders, (a) Gyracanthocephala, containing the families Quadrigyridae and Pallisentidae, and (b) Neoacanthocephala, comprising the families Neoechinorhynchidae and Hebesomidae.

Later, in 1948, VAN CLEAVE further expanded his ordinal scheme by elevating Eoacanthocephala to the rank of a Class and by raising Gyracanthocephala and Neoacanthocephala to full ordinal status. Plaeacanthocephala and Archiacanthocephala were, however, retained as Orders and were included in the Class Metacanthocephala which was created anew to embrace these two. Subsequent authors have, however, been reluctant in recognising the two Classes since in their opinion the distinguishing characters are not so contrasting as to merit retaintion of these higher categories. HYMAN (1951) has summarily deleted them and has retained Eoacanthocephala, Palaeacanthocephala and Archiacanthocephala as mere ordinal categories.

It is, however, unfortunate that Van Cleave could not formulate any comprehensive scheme of acanthocephalan classification except the following which he presented partly in 1936 and partly in 1948 :

Phylum	-	Acanthocephala VAN CLEAVE, 1941
Class	(I)	Eoacanthocephala (VAN CLEAVE, 1936)
Order	(a)	Gyracanthocephala (VAN CLEAVE, 1936)
Family	(1)	Quadrigyridae VAN CLEAVE, 1920
Family	(2)	Pallisentidae VAN CLEAVE, 1928
Order	(b)	Neoacanthocephala (VAN CLEAVE, 1936)
Family	(1)	Neoechinorhynchidae VAN CLEAVE, 1919
Family	(2)	Hebesomidae VAN CLEAVE, 1928
Class	(II)	Metacanthocephala VAN CLEAVE, 1948
Order	(a)	Palaeacanthocephala MEYER, 1931
Order	(b)	Archiacanthocephala MEYER, 1931

In an earlier article " A Tentative Survey of the Classification of Acanthocephala", VAN CLEAVE (1936: Mimeographed) dealt with the classification at Class and ordinal level at some length and later concisely published it in 1948 but he did not mention, in either publication, the families which he included under the Orders Palaeacanthocephala and Archiacanthocephala though he cited about thirty genera under these two Orders in his earlier article. However, in his other publications and in subsequent contributions he recognised the following families under the Order Palaeacanthocephala :

(a) Acanthogyridae THAPAR, 1927.

(b) Centrorhynchidae VAN CLEAVE,

(c) Echinorhynchidae COBBOLD, 1879.

(d) Fessisentidae VAN CLEAVE, 1931

(e) Filisomidae VAN CLEAVE, 1928

(f) Gorgorhynchidae VAN CLEAVE & LINCICOME, 1940

(g) Polymorphidae MEYER, 1931

(h) Prosthorhynchidae VAN CLEAVE, 1931, and

(i) Rhadinorhynchidae TRAVASSOS, 1923.

The inclusion of Acanthogyridae THAPAR, 1927 under the Order Palaeacanthocephala was, however, paradoxical but this controversy was perpetuated due to an error in the original description of the genus Acanthogyrus THAPAR, 1927 which was characterised by the presence of two cement glands in the males; it was presumably on this basis only that VAN CLEAVE (1936) and other subsequent authors retained that genus and its corresponding family under Palaeacanthocephala.

In the Order Archiacanthocephala, Van Cleave maintained the four families, Apororhynchidae SHIPLEY, 1900, Gigantorhynchidae HAMANN, 1892, Moniliformidae VAN CLEAVE, 1924 and Oligacanthorhynchidae SOUTHWELL & MACFIE, 1925 but later in 1953 he invalidated the family Pachsentidae MEYER, 1931 and the genus Travassosia MEYER, 1932 which was declared synonym of the genus Hamanniella TRAVASSOS, 1915. In the meanwhile Apororhynchidae was accorded an independent ordinal status by BYRD & DENTON (1949) who named it as the Order Sphaeracanthocephala, but this proposal was deferred by VAN CLEAVE (1953) and has not since been recognised by any of the subsequent workers except WARD (1951), but that too tentatively.

(B) Recent Taxonomy

Recent trends of acanthocephalan taxonomy are based on either the system of SOUTHWELL & MACFIE (1925) or of MEYER (1931). In recent years (1950 onward) comprehensive studies on the taxonomy of this group have been made by WARD (1951, 1952), VAN CLEAVE (1948, 1949, 1951 b, 1952, 1953), SPREHN (1958), GOLVAN (1956, 1958, 1960, 1962, 1964, 1969), PETROCHENKO (1956, 1958) and YAMAGUTI (1963). Of these investigators, the first four have followed MEYER'S System whereas the remaining two have adopted SOUTHWELL & MACFIE'S scheme.

WARD (1951) has compiled all the species described since 1933 (i.e. after the publication of Meyer's monograph) and has classified them under the two Classes, Eoacanthocephala and Metacanthocephala; the former comprising the two Orders, Gyracanthocephala and Neoacanthocephala and the latter three, viz, Palaeacanthocephala, Archiacanthocephala and Sphenacanthocephala. Except cataloguing she did not attempt any systematic evealuation of any of the taxa and, therefore, made all endorsements as were cited by the original authors of the various taxa.

VAN CLEAVE (1953) in his monograph " Acanthocephala of North American Mammals " furnished extensive reviews on the morphology and systematics of many acanthocephalan groups occurring in North America. As far as taxonomy is concerned, he reiterated his earlier (1936,1948) propositions and, while reviewing the systematics of the entire group, he furnished a tabular analysis of the four ordinal categories which he maintained under the two classes, Eoacanthocephala and Metacanthocephala. However, he modified the previous concepts of certain families and genera and accordingly re-defined the families Polymorphidae, Oligacanthorhynchidae, Moniliformidae, Gigantorhynchidae and Apororhynchidae but invalidated the genus Travassosia, the family Pachysentidae and the Order Sphenacanthocephala of BYRD & DENTON (1949). Further, he also furnished comprehensive analyses of the genera Corynosoma and Bolbosoma and those of the families Oligacanthorhynchidae and Moniliformidae occurring in the Nearctic mammals and concluded the study with a preview of the classification of the group and relevant comments on other related taxa.

The Soviet School further contributed to the expansion of acanthocephalan taxonomy principally through the contributions of PETROCHENKO (1956, 1958), who, in 1956 propounded an elaborate scheme. PETROCHENKO (loc. cit) maintained Acanthocephala a Class of the Phylum Aschelminthes and divided the former into three sub-classes, viz. Neoechinorhynchinea, Echinorhynchinea and Gigantorhynchinea ; 6 Orders (2 new), 21 families (4 new), 17 Sub-families (9 new) and 90 genera (8 new). Petrochenko designed his System after Southwell and Macfie's plan since since he has accepted and augmented the concepts, and used the terminology of the latter authors. He has entirely discarded the categories formulated by Meyer (1936) and Van Cleave (1936, 1948) and has equated the Classes Eoacanthocephala and Archiacanthocephala with his sub-classes Neoechinorhynchinea, Echinorhynchinea and partly with Gigantorhynchinea. The scheme of PETROCHENKO (1956) is as follows :

System of PETROCHENKO (1956)

Class Acanthocephala SKRJABIN & SCHULTZ, 1931

Subclass	(A)	Neoechinorhynchinea PETROCHENKO, 1956
Order	(I)	Neoechinorhynchida PETROCHENKO, 1956
Family	(1)	Neoechinorhynchidae VAN CLEAVE, 1919
Subfamily	(i)	Neoechinorhynchinae TRAVASSOS, 1926
Subfamily	(ii)	Gracilisentinae PETROCHENKO, 1956
Subfamily	(iii)	Eocollinae PETROCHENKO, 1956
Family	(2)	Hebesomidae VAN CLEAVE, 1928
Family	(3)	Tenuisentidae VAN CLEAVE, 1936
Subfamily	(i)	Atactorhynchinae PETROCHENKO, 1956
Subfamily	(ii)	Tenuisentinae (VAN CLEAVE, 1936)
Order	(II)	Acanthogyrida THAPAR, 1927
Family	(1)	Acanthogyridae THAPAR, 1927
Family	(2)	Quadrigyridae VAN CLEAVE, 1920
Class	(B)	Echinorhynchinea PETROCHENKO, 1956
Order	(I)	Echinorhynchida SOUTHWELL & MACFIE, 1925
Family	(1)	Echinorhynchidae COBBOLD, 1879
Subfamily	(i)	Hypoechinorhynchinae PETROCHENKO, 1956
Subfamily	(ii)	Echinorhynchinae MEYER, 1931
Subfamily	(iii)	Heteracanthocephalinae PETROCHENKO, 1956
Subfamily	(iv)	Leptorhynchoidinae PETROCHENKO, 1956
Family	(2)	Fessisentidae VAN CLEAVE, 1931
Family	(3)	Cavisomatidae VAN CLEAVE, 1931
Family	(4)	Pomphorhynchidae YAMAGUTI, 1939

Order	(II)	Polymorphida PETROCHENKO, 1956
Family	(1)	Arhythmacanthidae YAMAGUTI, 1935
Family	(2)	Rhadinorhynchidae TRAVASSOS, 1923
Subfamily	(i)	Rhadinorhynchinae LUHE, 1912
Subfamily	(ii)	Serrasentinae PETROCHENKO, 1956
Family	(3)	Telosentidae PETROCHENKO, 1956
Family	(4)	Polymorphidae MEYER, 1931
Subfamily	(i)	Polymorphinae MEYER, 1931
Subfamily	(ii)	Corynosominae PETROCHENKO, 1956
Subfamily	(iii)	Plagiorhynchinae MEYER, 1931
Class	(C)	Gigantorhynchinea PETROCHENKO, 1956
Order	(I)	Gigantorhynchida SOUTHWELL & MACFIE, 1925
Family	(1)	Gigantorhynchidae HAMANN, 1892
Subfamily	(i)	Gigantorhynchinae TRAVASSOS, 1915
Subfamily	(ii)	Centrorhynchinae (VAN CLEAVE, 1916)
Family	(2)	Filicollidae PETROCHENKO, 1956
Family	(3)	Pseudacanthocephalidae PETROCHENKO, 1956
Family	(4)	Prosthorhynchidae PETROCHENKO, 1956
Order	(II)	Oligacanthorhynchida PETROCHENKO, 1956
Family	(1)	Oligacanthorhynchidae SOUTHWELL & MACFIE,
Family	(2)	Moniliformidae VAN CLEAVE, 1924
Family	(3)	Pachisentidae MEYER, 1931 (sic).

The above scheme is the first of its type in which the concept of subclasses has been introduced and more orders have been recognised than were in previous systems. Since this one too is an augmentation of Southwell and Macfie's scheme, it also imbibes the same inconsistancies basically as does the former. The basic criteria which PETROCHENKO (1956) has used for differentiating between the subclasses is essentially the spination of the ebryos , distinguished as anechine, hemiechine and holoechine type, and secondly the retractility of the proboscis within the receptacle. Trunk spination, musculature of the proboscis receptacle and cement glands are accorded secondary significance.

Although PETROCHENKO (1956) has objected to the recognition of Eoacanthocephala and Metacanthocephala, he has unduly created the three sub-classes which are as unwarranted as the former. Further, the recognition of these three sub-classes on the basis of embrynic spination has already been refuted by GRABDA-KAZUBSKA (1964) who has shown that embryonic spination is not so consistent a character as to merit criterion for supra-ordinal categorization. Further, recognizing the Order Acanthogyridea for a few genera, which differ from those of the other orders simply in the presence or absence of trunk spines only (Acanthosentis as against Neoechinorhynchus, for example), hardly offers any justification. Of the nine genera which have been included in the two families of Acanthogyrida, three are direct synonyms of each other, whereas the other genus Diplosentis TUBANGUI & MASILUNGAN, 1937 does not belong in this Order, or for that matter in the Eoacanthocephala at all.

Likewise, the inclusion of Filicollidae, Prosthorhynchidae (for which Petrochenko accredits himself though the family was created earlier by Van Cleave in 1931). Pseudacanthocephalidae and the subfamily Centrorhynchinae under the Order Gigantorhynchida which in a natural system of classification qualifies to enclose typically archiacanthocephalan genera is obviously untenable. The above mentioned subfamily and families and their constituent genera are typically palaeacanthocephalan taxa in accordance with the concepts of MEYER (1931, 1932, 1938) and VAN CLEAVE (1936), particularly when it is evident that the constituent genera of the above groups manifest no close relationship with those ascribed to Gigantorhynchidae or to Archiacanthocephala neither on anatomical nor on biological grounds.

The family Gigantorhynchidae, according to Petrochenko's concept, is an inharmonius assemblage of two radically different subfamilies, Gigantorhynchinae and Centrorhynchinae, since the constituent genera of these two markedly differ from each other essentially on morphological basis, secondly, those of the former are chiefly parasitic in mammals whereas those of the latter invariably parasitise rapterial birds and if at all they occur in mammals, as incidental infections. The life-cycle pattern in the two subfamilies are also markedly different from each other; the intermediate host in Gigantorhynchinae is almost always a terrestrial arthropod whereas an aquatic insect as an intermediate host is interpolated in the life-cycle of most palaeacanthocephala including Centrorhynchinae. The Centrorhynchidae further employ paratenic hosts wherein the acanthellae or juveniles encyst in the mesenteries of the reptilian or avaian host. This difference is further supplemented by anatomical organization of the proboscis and the proboscis receptacle and also the nature of the cement glands. PETROCHENKO (1956) has grouped Gigantorhynchinae and Centrorhynchinae together since he believes the proboscis is incapable of being invaginated in the genera of the two sub-families but the present writer is unable to accept this pre-position since he has a number of speciemns belonging to various Palaeacanthocephalan genera including a few of the genus Centro-rhynchus in which the proboscis is completely or partly invaginated and is retracted even in the adults.

Similarly the family Pseudacanthocephalidae, with the genus Pseudacanthocephalus PETROCHENKO, 1956 as its nominal type, is untenable under Gigantorhynchida since Pseudacanthocephalus is identical with Acanthocephalus which PETROCHENKO (1956) places under Echinorhynchida. Consequently including the other so closely a related genus, or even an identical genera in two different Orders expose the limitations of the System. The genus Pseudacan-thocephalus, whose two species, P. bufonicola (KOSTYLEW,1941) and P. caucasicus (PETROCHENKO, 1953) typically occur in anurans, is considered a synonym of the genus Acanthocephalus and therefore the family Pseudacanthocephalidae would also fall a synonym of the family Echinorhynchidae.

Further, the creation of the Order Oligacanthorhynchida for the inclusion of the families Moniliformidae, Pachisentidae (sic) and Oligacanthorhynchidae appears unnecessary since the anatomical differences between the genera and species of the Oliga-canthorhynchida and Gigantorhynchida are not of such a degree necessitate their placement under different ordinal groups. Pachysentidae has already been synonimised with Oligacanthorhynchidae by VAN CLEAVE (1953) since the only difference between the two lies in the size and shape of the body of the species and ".... the intergrading conditions of the shells of the embryonated eggs" which, according to VAN CLEAVE (1953:28) "..... are features which merit no value above that for distinguishing between species"

The only other biological factor which could be offered in favour of the identity and validity of the two ordinal groups, Gigantorhynchida and Oligacanthorhynchida is the host-spectrum of their constituent species; those belonging to the former occur in birds and mammals whereas those belong to the latter stenoxenous and are found in mammals only. But if the palaeacanthocephalan genera (as included by Petrochenko: op cit) are relegated from Gigantorhynchida, and as they should be, then only the genera <u>Mediorhynchus</u> and <u>Apororhynchus</u> are retained as those which are parasitic in birds and have a global distribution; whereas the rest, belonging to the remaining families of the two 'Orders' essentially parasitise mammals and are mostly confined to the Neotropical realm.

Petrochenko's scheme thus appears an incompatible subjective assemblage of various families and supra-familial c categories which have been, in quite a few instances, based on criteria which are inconsistent and conflicting and lend little support for the acceptance of the System.

GOLVAN reviewed and elaborated the classification of Eoacanthocephala in 1958, of Palaeacanthocephala in 1960 and later in 1969 and of Archiacanthocephala in 1964. For the first two of these groups he adopted Van Cleave's propositions but for Archiacanthocephala GOLVAN (1964) essentially followed PETROCHENKO (1956) in retaining the two orders Gigantorhynchida and Oligacanthorhynchida. GOLVAN & HOUIN (1963) discarded the concepts of the classes Metacanthocephala and Eoacanthocephala since they deleted the former category but retaind the latter as an order only. Concurrently they proposed anew the super-family Echinorhynchoidea in which they initially included Diplosentidae and Gorgorhynchidae but later, in 1969, when they revised Echinorhynchoidea, ascribed 10 families and 12 subfamilies under the super-family. However, this concept of super-family, the Echinorhynchoidea, is not new though GOLVAN & HOUIN (loc. cit) accredit themselves since it is antedated by Echinorhynchoidea RAUTHER, 1929 which was an emended form of Echinorhynchata FAUST,1928

The scheme as envisaged by GOLVAN (1958, 1960, 1969) is cited below :

(GOLVAN, 1958)

Class	(I)	Eoacanthocephala (VAN CLEAVE,1936)
Order	(I)	Gyracanthocephala (VAN CLEAVE,1936)
Family	(1)	Quadrigyridae VAN CLEAVE, 1920
Subfamily	(i)	Quadrigyrinae (VAN CLEAVE, 1920)
Subfamily	(ii)	Pallisentinae (VAN CLEAVE, 1928)

Order	(II)	Neoacanthocephala (VAN CLEAVE,1936)
Family	(1)	Neoechinorhynchidae WARD,1918
Subfamily	(i)	Neoechinorhynchinae TRAVASSOS, 1926
Subfamily	(ii)	Floridosentinae GOLVAN, 1958
Subfamily	(iii)	Gracilisentinae PETROCHENKO, 1956
Subfamily	(iv)	Eocollinae PETROCHENKO, 1956
Family	(2)	Tenuisentidae VAN CLEAVE, 1936
Class	(II)	Metacanthocephala VAN CLEAVE, 1948
Order	(I)	Palaeacanthocephala MEYER, 1931, emend
Family	(1)	Illiosentidae GOLVAN, 1960
Family	(2)	Leptorhynchoididae WITENBERG, 1932
Family	(3)	Rhadinorhynchidae TRAVASSOS, 1923
Subfamily	(i)	Rhadinorhynchinae LUHE, 1912
Subfamily	(ii)	Gorgorhynchinae VAN CLEAVE & LINCICOME,
Subfamily	(iii)	Serrasentinae PETROCHENKO, 1956
Family	(4)	Fessisentidae VAN CLEAVE, 1931
Family	(5)	Diplosentidae TUBANGUI & MASILUNGAN,1937
Subfamily	(i)	Allorhadinorhynchinae GOLVAN,1969
Subfamily	(ii)	Diplosentinae GOLVAN & HOUIN, 1963
Family	(6)	Heteracanthocephalidae PETROCHENKO,1956
Subfamily	(i)	Heteracanthocephalinae PETROCHENKO,1956
Subfamily	(ii)	Aspersentinae GOLVAN, 1960
Family	(7)	Arhythmacanthidae YAMAGUTI, 1935
Subfamily	(i)	Neoacanthocephaloidinae GOLVAN, 1960
Subfamily	(ii)	Arhythmacanthinae YAMAGUTI, 1935

Subfamily	(iii)	Paracanthocephaloidinae GOLVAN, 1969
Family	(8)	Hypoechinorhynchidae GOLVAN, 1960
Family	(9)	Echinorhynchidae COBBOLD, 1879
Subfamily	(i)	Echinorhynchinae COBBOLD 1876 (sic)
Subfamily	(ii)	Yamagutisentinae GOLVAN, 1969.
Family	(10)	Pomphorhynchidae YAMAGUTI, 1939
Family	(11)	Paracanthocephalidae GOLVAN, 1960
Family	(12)	Polymorphidae MEYER, 1931
Subfamily	(i)	Corynosominae PETROCHENKO, 1956
Subfamily	(ii)	Polymorphinae MEYER, 1932
Family	(13)	Pseudacanthocephalidae PETROCHENKO, 1956
Family	(14)	Plagiorhynchidae GOLVAN, 1960
Subfamily	(i)	Plagiorhynchinae MEYER, 1931
Subfamily	(ii)	Sphaerechinorhynchinae GOLVAN, 1960
Subfamily	(iii)	Porrorchinae GOLVAN, 1956
Family	(15)	Centrorhynchidae GOLVAN, 1960
		GOLVAN (1962)
(?) Class	(III)	Archiacanthocephala MEYER,1931 emend
Order	(I)	Oligacanthorhynchida PETROCHENKO,1956
Family	(1)	Oligacanthorhynchidae SOUTHWELL & MACFIE,1925
Order	(II)	Gigantorhynchidae SOUTHWELL & MACFIE,1925
Family	(1)	Gigantorhynchidae HAMANN, 1892
Family	(2)	Moniliformidae VAN CLEAVE, 1924
Family	(3)	Apororhynchidae SHIPLEY, 1899

incertae sedis : Polyacanthorhynchidae GOLVAN, 1956

Although the above mentioned scheme of GOLVAN (1958-1969) appears more accomplished than that of PETROCHENKO (1956), it too contians certain discrepancies which warrent a re-assessment.

In the class Eoacanthocephala, the order Gyracanthocephala comprises the family Quadrigyridae only of which Acanthogyridae and Pallisentidae are considered synonyms but this seems an unjustified decision. The species belonging to the latter two families are so diverse and distinct, anatomically as well as ecologically that the two families they are respectively assigned to merit independent recognition. Quadrigyridae is a distinct group by itself and is confined to the Nearctic realm whereas Acanthogyridae and Pallisentidae are characteristically Old World families. Similarly the inclusion of the genera Heteracanthocephalus PETROCHENKO, 1956 and Sachalinorhynchus KROTOV & PETROCHENKO, 1956 under Heteracanthocephalidae is justified but that of Aspersentinae under this family is not appropriate since the latter (Aspersentinae) too is a distinct biological and natural gropus; if Leptorhynchoidinae , according to GOLVAN (1969, desrves upgrading than Aspersentinae too. Aspersentidae should be retained as a distinct family with the same definition and contents GOLVAN (1960) had earlier given for it. The constituent species of Aspersentidae are spinose, with characteristic dyssymetry of hooks and the geographical distribution confined to the Antarctic realm-between50 degrees latitude S SW and the Antarctic ice-shelf whereas Heteracanthocephalidae are parasites of the fishes of the North Pacific off Sakhalin and Japanese coasts.

The family Fessisentidae (sensu GOLVAN) too has been expanded into an artificial group by including such diverse genera into it as *Fessisentis* VAN CLEAVE, 1931, *Cavisoma* VAN CLEAVE, 1931, *Megapriapus* GOLVAN et al, 1964 and *Filisoma* VAN CLEAVE, 1928, each of which merit inclusion into a separate family ; in fact this has already been done in certain cases, e.g *Cavisoma* was ascribed to Cavisomatidae by VAN CLEAVE (1931), and Filisoma to Filisomatidae. Each of these genera possesses some characters typical of each; the excessively long, cylindrcal tandem testes in *Fessisentis*, short linguiform four cement glands in *Cavisoma*, a compact cement gland complex in *Paracavisoma* vo KRITSCHER,1957; structural dimorphism in the proboscis of *Megapriapus* GOLVAN, GRACIA RODRIGO & DIAZ-UNGRIA, 1964, short claviform proboscis and four elongate tubular cemnt glands in *Rhadinorhynchoides* and a long cylindrical proboscis and much longer tubular cement glands in two pairs in *Filisoma* are constant features which objectively differentiate these genera from their closely related congeners.

Further, the families Pseudacanthocephalidae GOLVAN,1960 and Paracanthocephalidae PETROCHENKO, 1960 are redundant since the nominal types of both these families conform with the basic concept of the family family Echinorhynchidae. The validity of *Paracanthocephalus* ACHMEROV & ACHMEROVA, 1941 has recently been affirmed by GRABDA-KAZUBSKA (1967) and it has been assigned to Echinorhynchidae quite aptly but *Pseudacanthocephalus* can no more be regarded different from *Acanthocephalus* and, therefore, both the families Paracanthocephalidae and Pseudacanthocephalidae fall synonyms of Echinorhynchidae.

In the Archiacanthocephala, which GOLVAN (1962) later proclaimed as a Class, the recognition of the two orders, Gigantorhynchidea and Oligacanthorhynchidea appears uncalled for since the criteria which have been assumed by PETROCHENKO (1956) and subsequently by GOLVAN (1962) are of familial value only. It will be better if the two ordinal categories thus proposed are merged with the order Archiacanthocephala sensu VAN CLEAVE, 1948 and the constituent species assigned to the former two orders are included within the families they were originally ascribed to under Archiacanthocephala.

Until recently YAMAGUTI (1963) has also formulated a system which he has essentially based on the one of Southwell and Macfie (1925). Yamaguti has retained the same four ordinal groups, Apororhynchidea, Neoechinorhynchidea, Echinorhynchidea and Gigantorhynchidea which PETROCHENKO (1956) had previously retained as a heritage from SOUTHWELL & MACFIE (1925). However, not all of Yamaguti's proposals are totally acceptable as some of them are subject to the same objections which are raised against the former two arbitrary systems of PETROCHENKO (1956) and GOLVAN (1958 through 1969).

YAMAGUTI (1963) proposed the following scheme :

1. Order Apororhynchidea THAPAR, 1927

Family (1) Apororhynchidae SHIPLEY, 1899, emend.

2. Order Neoechinorhynchidea SOUTHWELL & MACFIE, 1925

Family (1) Acanthogyridae THAPAR, 1927
Acanthodelta DIAZ-UNGRIA & RODRIGO, 1958
as an appendix to this family.

Family (2) Hebesomatidae VAN CLEAVE, 1928, nom. emendat.
Family (3) Neoechinorhynchidae VAN CLEAVE, 1919
Subfamily (i) Atactorhynchinae PETROCHENKO, 1956
= Floridosentinae GOLVAN, 1959 (sic)
Subfamily (ii) Eocollinae PETROCHENKO, 1956
Subfamily (iii) Gracilisentinae PETROCHENKO, 1956
Subfamily (iv) Neoechinorhynchinae TRAVASSOS, 1926
Subfamily (v) Tenuisentinae PETROCHENKO, 1956

Family (4) Quadrigyridae VAN CLEAVE, 1920

3. Order Echinorhynchidea SOUTHWELL & MACFIE, 1925

Family (1) Arhythmacanthidae YAMAGUTI, 1935
Family (2) Aspersentidae GOLVAN, 1960
Family (3) Diplosentidae TUBANGUI & MASILUNGAN, 1937
Family (4) Echinorhynchidae COBBOLD, 1879
Subfamily (i) Cavisomatinae MEYER, 1931
Subfamily (ii) Echinorhynchinae TRAVASSOS, 1920 (sic)
Subfamily (iii) Heteracanthocephalinae PETROCHENKO, 1956

Subfamily	(iv)	Hypoechinorhynchinae PETROCHENKO, 1956
Subfamily	(v)	Leptorhynchoidinae WITENBERG, 1932
Family	(5)	Fessisentidae VAN CLEAVE, 1931
Family	(6)	Filicollidae PETROCHENKO, 1956
Family	(7)	Micracanthorhynchinidae YAMAGUTI, 1963
Family	(8)	Plagiorhynchidae GOLVAN, 1960, em.
Subfamily	(i)	Plagiorhynchinae MEYER, 1931
Subfamily	(ii)	Sphaerechinorhynchinae GOLVAN, 1960
Family	(9)	Polymorphidae MEYER, 1931
Subfamily	(i)	Corynosomatinae PETROCHENKO, 1956
Subfamily	(ii)	Polymorphinae MEYER, 1931
Family	(10)	Pomphorhynchidae YAMAGUTI, 1939
Family	(11)	Rhadinorhynchidae TRAVASSOS, 1923
Subfamily	(i)	Illiosentinae GOLVAN, 1960
Subfamily	(ii)	Polyacanthorhynchinae PETROCHENKO, 1956
Subfamily	(iii)	Rhadinorhynchinae LUHE, 1912
Subfamily	(iv)	Serrasentinae PETROCHENKO, 1956

4. **Order Gigantorhynchidea** SOUTHWELL & MACFIE, 1925

Family	(1)	Centrorhynchidae VAN CLEAVE, 1916
Family	(2)	Gigantorhynchidae HAMANN, 1892
Family	(3)	Moniliformidae VAN CLEAVE, 1924
Family	(4)	Oligacanthorhynchidae SOUTHWELL & MACFIE, 1925
Subfamily	(i)	Macracanthorhynchinae YAMAGUTI, 1963
Subfamily	(ii)	Oligacanthorhynchinae YAMAGUTI, 1963
Subfamily	(iii)	Prosthenorchiinae YAMAGUTI, 1963 (sic)

Family (5) Prosthorhynchidae PETROCHENKO, 1956

Family (6) Pseudoacanthocephalidae PETROCHENKO, 1956.

In the above scheme, which comprises 4 orders, 22 families, 21 subfamilies and 95 genera, YAMAGUTI (1963) has proposed one new family, Micracanthorhynchinidae; three new subfamilies, Oligacanthorhynchinae, Macaracnthorhynchinae and Prosthenorchiinae and two new genera, Empodisma and Pseudauchen. The remaining are pre-existing taxa and are re-arranged in such a way that the entire scheme becomes an up-to-date (till 1962) version of Southwell and Macfie's ordinal system.

However, YAMAGUTI'S scheme also manifests certain marked discrepancies which call for rectification.

The order Apororhynchidea, or its equivalent, the Sphenacanthocephala conforms with the basic concept of Archiacanthocephala in which the family Apororhynchidae can be easily contained. Hence retaining any of the first two as separate ordinal categories does not seem plausible. Further, in the order Neoechinorhynchidea, the family Neoechinorhynchidae is distinguished from Hebesomatidae on the basis of only the presence or absence of 'globular prolongations of the middle egg shell' a character which can be met with in females. The only other differential character is the plump fusiform shape and thick body-wall which can at best be utilised to differentiate between the genera only and can hardly be regarged a character worth characterising a family for that. Hence Hebesomatidae is reduced as a synonym of Neoechinorhynchidae.

The family Acanthogyridae (sensu YAMAGUTI, 1963) comprises three genera, viz, Acanthogyrus, Acanthocephalorhynchoides and, tentatively, Acanthodelta. Acanthosentis and Raosentis, which are more closely related to Acanthogyrus than others are ascribed to Quadrigyridae. The present author does not subscribe to this view since he believes that Quadrigyridae is a distinct natural group of two genera, Quadrigyrus and Palliolisentis, distinguished anatomically as well as zoo-geographically. These two genera are confined to the Nearctic realm whereas the remaining, i.e. Pallisentis, Raosentis, and Acanthosentis are typically Oriental or Palaearctic genera. Acanthodelta is not only untenable with Acanthogyridae, it does not even belong in the Order Neoechinorhynchidea, nor for that matter in Eoacanthocephala ; instead, it merits recognition of a family for itself and accordingly the family Acanthdeltidae has been proposed in the present study to contain the genus Acanthodelta as its nominal type.

In the order Echinorhynchidea, the bracketing of the genus Heterosentis with Arhthmacanthus under the family Arhythmacanthidae is unjustified since the two are not even related with each other. The pattern of proboscis hooks (marked dorso-ventral differentiation) in Heterosentis is similar to one in Aspersentis and for this reason Heterosentis has recently been synonymised with the latter. In subfamily Cavisomatinae, Family Echinorhynchidae, the genera Cavisoma and Filisoma are so diverse that both do not deserve relegation from their original familial groups. Heteracanthocephalinae PETROCHENKO, 1956 should better have been retained as a family parallel with Aspersentidae rather than suppressed as a subfamily of Echinorhynchidae. Further, the inclusion of *Illiosentis* and *Tegorhynchus* under two different groups, Illiosentinae and Rhadinorhynchinae respectively, is also anomalous; in fact both belong in the same family/subfamily since the two are so closely related that BULLOCK & MATEO (1970) have even suggested their unification.

The inclusion of Centrorhynchidae, Prosthorhynchidae and Pseudoacanthocephalidae under the order Gigantorhynchidea is obviously the most controversial aspect of Yamaguti's scheme. The definition of the order as given by Yamaguti is too generalised and reflects little of the phylogenetic relationships among the genera or species of its constituent families. However, the genera *Centrorhynchus*, *Prosthorhynchus* and *Pseudacanthocephalus* are typically palaeacanthocephalan entities and do not conform with the concept of Gigantorhynchidea /Gigantorhynchidae as instituted by HAMANN (1892), TRAVASSOS (1926) or even MEYER (1931).

The family Pseudacanthocephalidae would no more be valid since its type genus, *Pseudacanthocephalus* concours with *Acanthocephalus*. Centrorhynchidae and Prosthorhynchidae should also be relegated from Gigantorhynchidea since their principal anatomical characters like proboscis and its spination, the muscular make-up of the proboscis receptacle and the nature of the cement glands is so different from the genera of other families in Gigantorhynchidae that their dissociation would relieve Gigantorhynchidea of uncompatible taxonomic obligation.

Yamaguti has aptly dispensed with the two gigantorhynchidean orders, Oligacanthorhynchida and Gigantorhynchida but his assertion for the creation of the subfamily Prosthenorchiinae is not justified since this subfamily was proposed much earlier by TRAVASSOS (1926). Hence Prosthenorchiinae YAMAGUTI, 1963 should be considered synonym of Prosthenorchiinae TRAVASSOS, 1926.

The present discourse is, however, an appraisal of Yamaguti's system at familial and sub-familial level but a critical evaluation of this system and of other recent schemes at generic and supra-generic levels would necessitate considerable emendmends and rectifications. Consequently a detailed analysis of all these schemes is endeavoured in the present study in order to evolve a system based on harmonius and phylogenetically compatible criteria so as to accord the scheme wider acceptance. This evaluation of the two orders, Eoacanthocephala and Palaeacanthocephala is first attempted family-wise and the conclusions thus obtained would be collated in the form of a revised scheme of the group concluded in the next chapter of the present study.

(C) Critical evaluation of the Orders Eoacanthocephala and Palaeacanthocephala.

(a) Order Eoacanthocephala.

VAN CLEAVE (1936) created the Order Eoacanthocephala to include the acanthocephalan parasites of poikilothermic hosts.

characterised with the presence of single layered proboscis receptacle and a syncytial cement gland. The order was further divided into two suborders, (a) Gyracanthocephala VAN CLEAVE,1936 and (b) Neoacanthocephala VAN CLEAVE, 1936; the two having been differentiated from each other through the presence or absence of trunk spines.

VAN CLEAVE (1948) later on proposed two calsses in the acanthocephala, the Eoacanthocephala and the Metacanthocephala and raised, at the same time, the two suborders, Gyracanthocephala and Neoacanthocephala to full ordinal rank. Subsequent authors have however been reluctant in accepting this proposition since they consider the contrasting features between the two classes are not significant enough to uphold their validity. HYMAN (1951) and BAER (1961), therefore, deleted Metacanthocephala and have, instead, recognised Eoacanthocephala, Palaeacanthocephala and Archiacanthocephala and Gyracanthocephala and Neoacanthocephala as suborders (of the first of these ordinal categories) and the present author has also complied with this proposition.

The suborder Gyracanthocephala originally included only two families, Quadrigyridae and Pallisentidae. The third family, Acanthogyridae, which should have also been included was assigned to Palaeacanthocephala by MEYER (1931, 1932) as well as by VAN CLEAVE (1936). Later on GOLVAN (1959) and BAER (1961) further restricted the suborder Gyracanthocephala to only one family - the Quadrigyridae which was subdivided into two subfamilies, Quadrigyrinae (VAN CLEAVE, 1920) and Pallisentinae (VAN CLEAVE,1928).

On the other hand PETROCHENKO (1956) and YAMAGUTI (1963) included Acanthogyridae and Quadrigyridae under Neoechinorhynchidea, a category equivalent to Gyracanthocephala in content. The present author does not concur with this decision of GOLVAN (1959) and of BAER (1961) and partly of PETROCHENKO (1956) and YAMAGUTI (1963) and , instead, proposes that Acanthogyridae, Pallisentidae and Quadrigyridae should be recognised as distinct families under the suborder Gyracanthocephala of the Order Eoacanthocephala.

Acanthogyridae was formerly assigned to Palaeacanthocephala because THAPAR (1927) had originally described 'two cement glands' in Acanthogyrus acanthogyrus and this had led VAN CLEAVE (1936), MEYER (1932) and WARD (1951) to place Acanthogyridae under Palaeacanthocephala. but the speculation of DOLLFUS & GOLVAN (1956) and of BAER (1961) is confirmed by the present author on the basis of re-examination of holotype male of A. acanthogyrus (ZSI No: W 5252/1) and histological preparation of paratype male in the same series (ZSI No : W 3803/1) which indicates conclusively the single syncytial nature of the cement gland and this, therefore, qualifies Acanthogyridae for inclusion under Gyracanthocephala. The unification of Quadrigyridae and Pallisentidae too is unwarranted since the two families represent morphologically and biogeographically two distinct natural groups.

Quadrigyridae is characterised by forms with typical trunk spination (minute spines with stellate bases, disposed in 4-6 circular rows anteriorly only) and giant dendritic hypodermal nuclei in the post-equatorial half of the trunk. Such nuclei are characteristic of the genus Quadrigyrus and Pallisentis only and are of substantial taxonomic significance. Further, the zoogeographic distribution of these two genera is also distinct since they are confined to the Neotropical realm where they have undergone marked speciation. Quadrigyrus cholodkowskii KOSTYLEW, 1928 from Armenia is a mis-attribution since it does not belong in the genus Quadrigyrus but conforms with the concept of the genus Acanthocephalorhynchoides KOSTYLEW, 1941. However, in view of the two above mentioned characters, the family Quadrigyridae appear best be restricted to the two genera, Quadrigyrus and Pallisentis and be regarded as a distinct Neotropical acanthocephalan family. Its suppression as a subfamily hence becomes redundant.

Quadrigyridae was originally a monotypic family and included the genus Quadrigyrus only. The genus too was monotypic and initially contained the nominal type, Q. torquatus only but later on two more species, Q. brasiliensis MACHADO FILHO, 1941 and Q. cholodkowskyi KOSTYLEW, 1928 were added to it. The latter, as noted above, does not belong to the genus it was originally referred to but is perhaps identical with Acanthocephalorhynchoides ussuri- which has been reported from the same host of the same region as of the former. Secondly the arrangement of trunk spines and the form of the hypodermal nuclei are contrary to the concept of the genus Quadrigyrus. Quadrigyrus brasiliensis, the other species in in this genus is, however, readily distinguishable from its other congener, Quadrigyrus torquatus through its general organisation.

Palliolisentis, the other genus, was added to Quadrigyridae by MACHADO FILHO in 1960. This genus comprised two distinct species, *Palliolisentis quinqueungulis* MACHADO FILHO, 1960 and *P. ornatus* MACHADO FILHO, 1960 and these species indicate the trend of speciation among the Quadrigyridae in South America. The occurrence of spinose forms similar to *Tenuisentis* may be speculated as a next sequence of speciation in this group in the Neotropical realm where Eoacanthocephala are well distributed.

The genus *Heterosentis* VAN CLEAVE, 1938 was also included under Quadrigyridae but it was relegated from it and assigned under Palaeacanthocephla by VAN CLEAVE (1936) and later on added to Arhythmacanthidae by YAMAGUTI (1935). As discussed later, *Heterosentis* does not belong in the Arhythmacanthidae too since the pattern of its proboscis hooks is not in consonance with the pattern of *Arhythmacanthus* but resembles that of *Aspersentis*; hence transferred to family Aspersentidae.

Pallisentidae is characterised by relatively larger forms with typical trunk spination demarcated into two successive zones interrupted by a short smooth aspinose field, zoogeographically confined to the Palaearctic and Oriental realms with further extension in distribution eastward to Thailand, Malaysia (FERNANDO & FURTADO, 1963) and Indonesia (YAMAGUTI, 1954). The constituent species are characterised also by the organization of the proboscis and the form of trunk spines which are largest among all the Eoacanthocephalan species. Secondly the cement gland and the cement reservoir are voluminous and the efferent ducts are paired.

Initially the family contained the two closely related genera, *Pallisentis* and *Neosentis* but later on a few more were ascribed to it. *Fargandia* THAPAR, 1931 was the other identical genus, indistinguishable from *Pallisentis* but was originally assigned to Acanthogyridae. On account of their congeneric identity *Neosentis* and *Fargandia* were synonymised with the genus *Pallisentis* by HARADA (1935) and BAYLIS (1933), respectively, but the latter author, at the same time, suggested the merger of Pallisentidae with Quadrigyridae.

Another genus, Saccosentis TADROS, 1966 was also assigned to Quadrigyridae. Its type species, Saccosentis pesteri TADROS,1966 described from Saccobranchus fossilis of 'Far East', however, conforms with the concept of *Pallisentis* from which it was originally differentiated through the presence of a bipartite cement gland in the former although from its original diagrams it appears that the cement gland of *S. pesteri* is not so but is slightly constricted and furrowed in the middle. In all other features it is in consonance with the definition of *Pallisentis* and should, therefore, be considered its junior synonym and the type species be renamed as *Pallisentis pesteri* (TADROS,1966) n. comb

Devendrosentis SAHAY, SINHA & GHOSH, 1971 has unnecessarily been inflicted upon Pallisentidae as a new genus. Its type species, *Devendrosentis garuai* SAHAI et al, 1971 is in no way different from *Pallisentis nagpurensis* (BHALERAO,1931) except that it is reported from a new host. No further comment on this genus i.e. *Devendrosentis* seems necessary and it also is considered a junior synonym of *Pallisentis* and its type species, *D. garmai* of *Pallisentis nagpurensis*. Hence Pallisentidae is retained as an independent family presently comprising the genus *Pallisentis* only of which *Neosentis*, *Farzandia*, *Saccosentis* and *Devendrosentis* are direct synonyms.

Two more genera, *Acanthocephalorhynchoides* KOSTYLEW, 1941 (Type : *A. ussuriensis* KOSTYLEW,1941) and *Hemigyrus* ACHMEROV & DOMBROVSKAJA-ACHMEROVA, 1941 (Type : *H. intermedius* ACHMEROV & DOMBROVSKAJA-AKHMEROVA,1941), both known through a single female specimen, were assigned to Quadrigyridae by their respective authors and to Pallisentidae by GOLVAN (1959). They were later reviewed and synonymised with each other by PETROCHENKO (1956) who relegated *Acanthocephalorhynchoides* to Acanthogyridae. The species *Acanthocephalorhynchoides ussuriensis* , however, closely resembles *Quadrigyrus cholodkowskii* but the paucity of the original description of the former does not lead to any conclusive decision regarding it synonymy. The specis concerned, however, need a rectification and till such time a detailed description of its male is known, it is better considered a species inquirendum.

Acanthogyridae also is a small but distinct gyracanthocephalan group. Originally it included various genera which, except the type genus, *Acanthogyrus* and the other, *Quadrigyrus*, did not even conform to Neoacanthocephala. However, the concept of Acanthogyridae as restricted to the inclusion of *Acanthogyrus* and related genera is distinct by itself. The family comprises four genera, *Acanthogyrus*, *Acanthosentis*, *Raosentis* and *Acanthocephalorhynchoides*. *Acanthogyrus* and *Acanthosentis* are almost twin genera and the only differential separating the two is the extent of trunk spines which exend posteriorly upto the genital orifice in the former but stop short of anterior middle in the latter. This character has frequently been by-passed by various authors and has resulted in the misplacement of certain species under these two genera. In the present study the genus Acanthogyrus is essentially distinguished with the characters mentioned above and accordingly a reorganisation of species under these two genera is attempted. Consequently the genus Acanthogyrus would comprise the following species :

(1) Acanthogyrus acanthogyrus THAPAR,1927 - the type.

(2) Acanthogyrus nigeriensis DOLLFUS & GOLVAN,1956.

(3) Acanthogyrus tilapiae (BAYLIS,1948)

(4) Acanthogyrus thapari n. sp.

Acanthogyrus tripathii RAI,1967 is in all possiblities a junior synonym of Acanthogyrus acanthogyrus THAPAR.

In Acanthogyrus partispinus FURTADO, 1963 the organisation of proboscis hooks and the pattern of trunk spines conforms with the characters of the genus Raosentis and accordingly the aforesaid species is transferred to the latter and renamed Raosentis partispinus (FURTADO,1963) n. comb.

GOLVAN (1959) divided the genus Acanthogyrus into two subgenera, (i) Acanthogyrus, the nominal type and (ii) Acanthosentis. The former included A. acanthogyrus whereas the latter comprised eight species but out of these, Acanthogyrus (Acanthosentis) cholodkowskii (KOSTYLEW,1928) and A. (Acanthosentis) intermedius (ACHMEROV

DOMBROVSKAJA-ACHMEROVA, 1941) are untenable within the genus *Acanthogyrus*: these two have already been synonymised with each other but belong to the genus *Acanthocephalorhynchoides* ; hence *Q. cholodkowskii* (KOSTYLEW) is renamed as *Acanthocephalorhynchoides cholodkowskii* (KOSTYLEW, 1928) n. comb.

Acanthosentis VERMA & DATTA, 1929, the genus most closely related to *Acanthogyrus* was originally assigned to the family Quadrigyridae and this was subsequently accepted by MEYER (1932), PETROCHENKO (1956), GOLVAN (1959), TRIPATHI (1959) and YAMAGUTI (1963) but VAN CLEAVE (1936) and WARD (1951) have included it under Pallisentidae. DOLLFUS & GOLVAN (1956) had earlier suggested Acanthosentis as a synonym of *Acanthogyrus* and this view was later explicited by GOLVAN (1959) again but the present author does not submit to this view. The species belonging to these two genera are distinguished from each other through their trunk spination; secondly, those of *Acanthogyrus* occur mainly in carps whereas these belonging to Acanthosentis have a broader host-spectrum. Due to this close relationship between *Acanthosentis* and *Acanthogyrus*, the former is also included within Acanthogyridae and comprises the following species :

(1) *Acanthosentis* ant *antispinus* VERMA & DATTA, 1929
(2) *Acanthosentis acanthuri* CABLE & QUICK, 1954
(3) *Acanthosentis holospinus* SEN, 1938
(4) *Acanthosentis moroccanus* DOLLFUS, 1951
(5) *Acanthosentis giuris* SOOTA & SEN, 1954
(6) *Acanthosentis indica* TRIPATHI, 1959
(7) *Acanthosentis cameroni* GUPTA & KAKAJI, and
(8) *Acanthosentis pausiumsinatus* n. sp.

Raosentis DATTA, 1947 also was originally ascribed to Quadrigyridae. WARD (1951), PETROCHENKO (1956), GOLVAN (1959) and YAMAGUTI (1963) have also accepted this arrangement but the present author tends to believe that it belongs to the family Acanthogyridae since Quadrigyridae is restricted as a Neotropical family and *Raosentis* seems to have no closer affinity with either of the Quadrigyrid genus. Secondly, *Raosentis* differs from *Acanthosentis* in having only one more circle of basal proboscis hooks and from *Acanthogyrus* in this aspect as well as in having the trunk spines confined to anterior 1/3 of the trunk.

The various species of *Acanthogyrus*, *Acanthosentis* and Raosentis have presumably evolved from a common ancestral stock and these species ahve undergone speciation and adaptive radiation in the fresh-water fishes of the Oriental, Palaearctic and Ethipian regions. Occassional occurrence of a few species elsewhere is, perhaps, a matter of exotic origin.

The genus *Acanthodelta* DIAZ-UNGRIA & GARCIA RODRIGO, 1958 also originally described under Quadrigyridae has been appended to Acanthogyridae by YAMAGUTI (1963). This genus is not tenable under any of these families and for reasons discussed earlier in the present study (page 60), it is relegated from Gyracanthocephala to Palaeacanthocephala and is assigned to the family Acanthodeltidae which has been created anew to accommodate it.

The suborder Gyracanthocephala thus comprises three families, Quadrigyridae, Pallisentidae and Acanthogyridae; the first of these restricted to Neotropical realm and the other two to Oriental.

The contents of these three families are as follows :

I. Family Quadrigyridae VAN CLEAVE, 1920

1. Genus <u>Quadrigyrus</u> VAN CLEAVE, 1920

2. Genus <u>Pallisolisentis</u> MACHADO FILHO, 1951

II. Family Acanthogyridae THAPAR, 1927

1. Genus <u>Acanthogyrus</u> THAPAR, 1927

2. Genus <u>Acanthosentis</u> VERMA & DATTA, 1929

3. Genus <u>Raosentis</u> DATTA, 1947

4. Genus <u>Acanthocephalorhynchoides</u> KOSTYLEW, 1941

III. Family Pallisentidae VAN CLEAVE, 1928

1. Genus <u>Pallisentis</u> VAN CLEAVE, 1928.

The suborder Neoacanthocephala too originally included two families, Neoechinorhynchidae and Hebesomatidae but a third one, the Tenuisentidae was added to it soon after (VAN CLEAVE, 1936 b). These three families were later on assigned to the Order Neoechinorhynchida of the sub-class Neoechinorhynchinea by PETROCHENKO (1956) and to the Order Neoechinorhynchidea by YAMAGUTI (1963) weheress GOLVAN (1959) and BAER (1961) have retained them under the suborder Neoacanthocephala of the Order Eoacanthocephala. But these authors have deleted the family Hebesomatidae (originally named Hebesomidae by VAN CLEAVE, 1928) since it was previously merged with Neoechinorhynchidae by MEYER (1932). In recent years, however, Hebesomatidae has been considered a valid family by PETROCHENKO (1956), ROYTMAN (1961), YAMAGUTI (1963) and SOKOLOWSKAIA (1967). The present author does not share this view since in his opinion the characteristic features of Hebesomatidae coincide so much with those of Neoechinorhynchidae that the former hardly maintains its identity. *Hebesoma*, however, remains a valid genus and its synonymy with *Neoechinorhynchus* has rightly been revoked by the four erstwhile authors.

SOKOLOWSKAIA (1967) has proposed one more family, Dendronucleatidae under Neoechinorhynchida. This family is typified by the Genus *Dendronucleata* SOKOLOWSKAIA,1967 which includes two species, *Dendronucleata dogieli* SOKOLOWSKAIA,1967 and *D. petruschewskii* SOKOLOWSKAIA,1967. These closely resemble *Neoechinorhynchus* but have been distinguished from it by the presence of numerous large, dendritic, some stellate hypodermal nuclei. The number and arrangement of proboscis hooks is same as in *Neoechinorhynchus* and general body organisation too is identical in both these genera. Consequently the differential features which characterise Dendronucleatidae can at best be regarded as of generic value since they are not lent support by other somatic characters. The present author, therefore, proposes that the family Dendronucleatidae should be considered a synonym of Neoechinorhynchidae and the genus *Dendronucleata*, along with its two species be transferred to the latter family. He further agrees with GOLVAN (1959) and BAER (1961) that the suborder Neoacanthocephala should be restricted presently to the two families, Neoechinorhynchidae and Tenuisentidae, the former comprising genera with either a constant hooks formula or those with relatively lesser diagonal or oblique rows of proboscis hooks, and the latter with forms having elongated proboscis with numerous longitudinal rows of hooks.

The family Neoechinorhynchidae was originally proposed as Neorhynchidae by HAMANN (1892) but was later renamed as Eorhynchidae by VAN CLEAVE (1914) since Neorhynchus was found to be a homonym, preoccupied by a Coleopteran genus. But Neorhynchus was already emended to Neoechinorhynchus by HAMANN (1905) and the family name was also emended as Neoechinorhynchidae by TRAVASSOS (1917) though WARD (1918) and VAN CLEAVE (1919) later proposed this family name independently and as such it has often been cited by many workers.

Neoechinorhynchidae was first reviewed by TRAVASSOS (1926) and was divided into the subfamilies, (a) Neoechinorhynchinae and (b) Quadrigyrinae. This classification was omitted by MEYER (1931) who placed Neoechinorhynchidae under the Order Archiacanthocephala. The family was monotypic originally and had included Neoechinorhynchus only as its type genus. Later on six more genera viz., Tanaorhamphus WARD, 1918, Gracilisentis VAN CLEAVE, 1919, Octospinifer VAN CLEAVE, 1919, Pandosentis VAN CLEAVE, 1920, Hebesoma VAN CLEAVE, 1928 and Eosentis VAN CLEAVE, 1928 were added to it by MEYER (1932). Subsequent to the publication of Meyer's monograph, four more genera, viz, Atactorhynchus CHANDLER, 1937, Eocollis VAN CLEAVE, 1947, Paulisentis VAN CLEAVE & BANGHAM, 1949 and Floridosentis WARD (1953) were described in Neoechinorhynchidae and this diversity of genera prompted PETROCHENKO (1956) to create three more subfamilies, under Neoechinorhynchidae and two under

Tenuisentidae. Accordingly he classified Neoechinorhynchidae into three subfamilies, Neoechinorhynchinae TRAVASSOS,1926, comprising Neoechinorhynchus, Octospinifer, and Paulisentis. Gracilisentinae PETROCHENKO,1956, to include Gracilisentis and Eocollinae PETROCHENKO,1956 for the genus Eocollis only. The genera Atactorhynchus, and Floridosentis were included within the subfamily Atactorhynchinae PETROCHENKO,1956 which was assigned to Tenuisentidae. Hebesomidae (sic) has been recognised as an independent family and contained the genus Hebesoma only.

Later on two more genera, Hexaspiron DOLLFUS & GOLVAN, 1956, with H. nigericum DOLLFUS & GOLVAN,1956 as type species, and Octospiniferoides BULLOCK,1957, with O. chandleri BULLOCK,1957 as the type, were described from Africa and North America, respectively. These genera were also included in Neoechinorhyn-dae by their respective authors.

GOLVAN (1959) divided Echinorhynchidae into four families; (a) Neoechinorhynchinae with Neoechinorhynchus, Hebesoma, Hexaspiron, and Paulisentis, (b) Floridosentinae (new subfamily) with Florido-sentis, Atactorhynchus and Octospinifer . (c) Gracilisentinae with Gracilisentis and Pandosentis, and (d) Eocollinae with Eocollis only. YAMAGUTI (1963) also endorsed the same arrangement except that he considered Floridosentinae GOLVAN,1959 synonym of Atacto-rhynchinae PETROCHENKO,1956 and Octospiniferoides BULLOCK,1957 of Octospinifer CHANDLER,1937 which he appropriately retained in Neoechinorhynchinae. Pandosentis was also removed from Gracili-sentinae and shifted to Tenuisentidae.

The present author, however, does not concur with YAMAGUTI (1963) regarding the synonymy of Octospiniferoides with Octospinifer. Through the generous co-operation of Dr. Wilbur L. Bullock and of US National Museum, the writer has had the privilege of examining type specimens of three species, Octospinifer macilentus VAN CLEAVE,1919, O. torosus VAN CLEAVE & HADERLIE,1950 and also of Octospiniferoides chandleri BULLOCK,1957 and arrive at the conclusion that both these genera are distinct and valid. Octospiniferoides can be distinguished through its presomal anatomy, hook pattern and general body size. The proboscis in Octospiniferoides chandleri is claviform and is beset with minute hooks disposed in circular or transverse rows; the roots of these hooks are also typical since they are vertical and anteriorly manubriate. Apparently the pattern simulates the one in Gracilisentis gracilisentis than with any other neoechinorhynchine genus. Secondly, the size of Octospiniferoides chandleri is markedly smaller; the adult specimens are never more than a feww millimeters in length whereas those of Octospinifer are larger forms ranging between 5 and 10 mm in length. The proboscis in either species of Octospinifer is spherical, the apicals much longer than the hooks of second and basal circles and the proboscis hook-pattern is similar to that in Neoechinorhynchus spp. YAMAGUTI (1963) was scepticticai because the original description of O. chandleri was based on two immature females but the redescription of this species based on mature specimens, males as well as females by BULLOCK (196 has re-affirmed the validity of the genus Octospiniferoides which belongs to the subfamily Gracilisentinae on account of its hook-pattern.

Five more genera, Zeylanechinorhynchus FERNANDO & FURTADO,1963, Microsentis MARTIN & MULTANI,1966, Dendronucleata SOKOLOWSKAIA,1967, Dispiron BILQEES,1970 and Gorytocephalus NICKOL & THATCHER,1971 have been described during recent years and have been assigned to Neoechinorhynchidae except Dendronucleata which was referred to its own family, Dendronucleatidae, and all, except the last named genus are monotypic.

Zeylanechinorhynchus , with Z. longinuchalis FERNANDO & FURTADO,1963 is characterised by the presence of 4 transverse/circular rows of 7 hooks each; those of the anterior two rows being larger and those of the basal successive rows smaller. In this respect Zeylanechinorhynchus comes close to Hexaspiron but can be distinguished from the latter in having relatively much smaller a size and also in the organisation of male reproductive organs. The genus, however, belongs in Neoechinorhynchinae by virtue of its closer affinities with the genus Echinorhynchus.

Microsentis, with M. wardae MARTIN & MULTANI,1966 as its type has been described from a marine fish, Gillichthys felis of La Jolla, California and has been assigned to Tenuisentidae by its original authors. Microsentis wardae is distinguished by having small oval proboscis armed with 16-10 longitudinal rows of 5-7 hooks each, small fusiform trunk and hooks similar to those in Octospiniferoides. Its assignment to Tenuisentidae is,however, untenable since the species belonging to the latter family are larger forms with elongate cylindrical proboscis armed with numerous hooks disposed in longitudinal rows. Instead, Microsentis belongs to Atactorhynchinae wherein it would assume an intermediate position between _Atactorhynchus_ and _Pandosentis_.

Dendronucleata SOKOLOWSKAIA, 1967 is the only isotypic genus among the five under review. A preliminary discussion on its systematic position has already been furnished in this study (page 190) and accordingly the genus, along with the two species, _D. dogieli_ and _D. petruschevskii_ are included in the subfamily Echinorhynchinae.

Dispiron BILQEES, 1970 is represented by _D. mugilis_ BILQEES, 1970 from _Mugil buchanani_ of Karachi, Pakistan. The original description is, however, inadequate and inconclusive. The genus has been characterised by two diagonally transverse rows of hooks which the present writer thinks was an omission in their counting. The original diagrams, which too are inadequate, possibly indicate the hooks were counted on proboscis partly inverted, thereby resulting in the omission of the basal circle of hooks which might have been superimposed on the third circle. The genus, however, needs verification and till such time it is dine, it should better be regarded as identical with _Neoechinorhynchus_ whose species commonly infest Mugiliformes in the Arabian Sea.

Gorytocephalus NICKOL & THATCHER, 1971 has recently been established to accommodate _G. prochilodorum_ from a fresh-water fish, _Prochilodus reticulatus_ of Colombia. The genus is characterised by the presence of a muscular sling around the proboscis receptacle, splitted posteriorly through which the basal region of the receptacle projects and a dorsal integumentary crest. The proboscis hooks are similar to those in Neoechinorhynchus species in their number and shape and other features are also alike. Hence Gorytocephalus is also assigned to Neoechinorhynchinae.

Tenuisentidae is the other distinct family of the suborder Neoacanthocephala. Originally it comprised Tenuisentis only but later on Van Cleave (1936 b) added Tanaorhamphus in this family also. PETRICHENKO (1956) divided it into two families, (a) Atactorhynchinae and (b) Tenuisentinae (VAN CLEAVE,1936), the latter comprising Tenuisentis, Pandosentis and Tanaorhamphus. YAMAGUTI (1963) has also endorsed this view while GOLVAN (1959) has not accepted it since he has included only Tenuisentis and Tanaorhamphus in this family and has assigned Pandosentis to Gracilisentinae. The present author also agrees with GOLVAN (1959) in this regard and differs from PETROCHENKO (1956) in including Pandosentis within Tenuisentidae since the proboscis organisation of P. iracundus (Berlin Museum Material; courtesy G. Hartwich) does not conform with that of Tenuisentis niloticus or Tanaorhamphus ambiguus (USNM material). The assignment of Atactorhynchinae under this family is also unwarrented and it has accordingly been included within Neoechinorhynchidae. The suppression of this family to Tenuisentinae, as envisaged by PETROCHENKO (1956) also becomes redundant and therefore it is restored as a full fledged family comprising the genera Tenuisentis and Tanarhamphus only.

The suborder Neoacanthocephala thus comprises :

I. Family Neoechinorhynchidae TRAVASSOS, 1917

1. Subfamily Neoechinorhynchinae TRAVASSOS, 1926

(i) Genus *Neoechinorhynchus* HAMANN, 1905

(ii) Genus *Octospinifer* VAN CLEAVE, 1919

(iii) Genus *Hebesoma* VAN CLEAVE, 1928

(iv) Genus *Hexaspiron* DOLLFUS & GOLVAN, 1956

(v) Genus *Zeylanechinorhynchus* FERNANDO & FURTADO, 1963

(vi) Genus *Dendronucleata* SOKOLOWSKAIA, 1967

(vii) Genus *Gorytocephalus* NICKOL & THATCHER, 1972

2. Subfamily Gracilisentinae PETROCHENKO, 1956

(i) Genus *Gracilisentis* VAN CLEAVE, 1919

(ii) Genus *Octospiniferoides* BULLOCK, 1957

3. Subfamily Atactorhynchinae PETROCHENKO, 1956

(i) Genus *Atactorhynchus* CHANDLER, 1937

(ii) Genus *Floridosentis* WARD, 1953

(iii) Genus *Paulisentis* VAN CLEAVE & BANGHAM, 1949

(iv) Genus *Microsentis* MARTIN & MULTANI, 1966

(v) Genus *Pandosentis* VAN CLEAVE, 1920

4. Subfamily Eocollinae PETROCHENKO, 1956

(i) Genus *Eocollis* VAN CLEAVE, 1947

II. Family Tenuisentidae VAN CLEAVE, 1936

(i) Genus *Tenuisentis* VAN CLEAVE, 1936

(ii) Genus *Tanaorhamphus* WARD, 1918.

(b) Order Palaeacanthocephala MEYER, 1931

MEYER (1931) proposed the order Palaeacanthocephala to accommodate the families Acanthogyridae, Quadrigyridae, Rhadinorhynchidae, Fessisentidae, Echinorhynchidae and Polymorphidae. The latter two of these families were further classified into three subfamilies each; Echinorhynchidae into (a) Echinorhynchinae, (b) Cavisominae (sic) and (c) Pomphorhynchinae and Polymorphidae into (a) Polymorphinae, (b) Centrorhynchinae and (c) Plagiorhynchinae. All these subfamilies were created anew by MEYER (1931). In designing this ordinal group MEYER (1931) laid emphasis on the nature of hypodermal nuclei, lateral position of the main lacunar canals, quincunxial arrangement of proboscis hooks, occurrence of trunk spines in primitive genera, intermittent nature of the ligament sacs in females and the polar modifications of the middle egg-shell.

VAN CLEAVE (1936) moderated the concept of this order by taking into account such characters as the double-layered proboscis receptacle and multiple tubular or follicular multinucleate cement glands in the males. Accordingly Acanthogyridae and Quadrigyridae were shifted from Palaeacanthocephala since they did not conform with the ordinal concept and were later transferred to Eoacanthocephala whereas the Palaeacanthocephala were confined to the remaining four families assigned to it by MEYER (1932). A few more families and subfamilies were described by other workers which agreed with the definition of Palaeacanthocephala but these were recognised neither by MEYER (1931,1932) nor by VAN CLEAVE (1936) in their respective schemes. These included the families

Centrorhynchidae VAN CLEAVE, 1916, Filisomidae VAN CLEAVE,1928, Prosthorhynchidae VAN CLEAVE, 1931, Oligoterorhynchidae VAN - CLEAVE, 1931, Arhythmacanthidae YAMAGUTI, 1935 and the subfamilies Corynosominae WITENBERG, 1932 and Leptorhynchoidinae WITENBERG,1932. TUBANGUI & MASILUNGAN (1937) added Diplosentidae., with the genus Diplosentis TUBANGUI & MASILUNGAN,1937 as its type, to this order and later YAMAGUTI (1939) established Pomphorhynchidae to include the genera Pomphorhynchus, Longicollum and Tenuiproboscis. Rhadinorhynchidae was revised by VAN CLEAVE & LINCICOME (1940) and was splitted into two families, Gorgorhynchidae and Rhadinorhynchidae (s.s), the two sharing the genera which were previously ascribed to the latter only. All these families thus far described, including Acanthogyridae, were subsequently included within the Palaeacanthocephala by WARD (1951). The inclusion of Acanthogyridae was, however, contrary to the concept of Palaeacanthocephala but it was inordinate and was rectified later on.

PETROCHENKO (1956) created the subclass Echinorhynchinea with the contents of the order Palaeacanthocephala and divided the former into two orders, (a) Echinorhynchida and (b) Polymorphida the two having been differentiated from each other mainly on the basis of the spination over the embryo. The former contained the families Echinorhynchidae COBBOLD, 1879, Fessisentidae VAN CLEAVE, 1931, Cavisomatidae (VAN CLEAVE,1931) emend. PETROCHENKO,1956 and Pomphorhynchidae YAMAGUTI,1939 ; the latter Order comprised : Arhythmacanthidae YAMAGUTI, 1935, Rhadinorhynchidae TRAVASSOS,1923, Telosentidae PETROCHENKO,1956 and Polymorphidae MEYER,1931.

In addition to other families, PETROCHENKO (1956) created three more families, viz. Filicollidae, to include the genera Filicollis LUHE,1911 and Parafilicollis PETROCHENKO,1956 , Pseudoacanthocephalidae for the genus Pseudoacanthocephalus PETROCHENKO,1956 and Prosthorhynchidae to contain the genera Prosthorhynchus KOSTYLEW,1915, Porrorchis FUKUI,1929 and Pseudoporrorchis JOYEUX & BAER,1935. These three families, which have closer affinities with Palaeacanthocephala were assigned by PETROCHENKO (1956) to the Order Gigantorhynchida under the subclass Gigantorhynchinea PETROCHENKO,1956 and Centrorhynchinae MEYER,1931 was included within Gigantorhynchidae on the basis of spination of the embryo and the non-retractility of the proboscis.

This is perhaps the most significant incongruity of PETROCHENKO's scheme which has transformed Gigantorhynchinea into an inharmonius assemblage of diverse genera classified on inconclusive basis. The genera pertaining to all these three families exhibit typical Palaeacanthocephalan characteristics, e.g. the hooks are arranged either in quincunxial pattern (Porrorchis, Pseudoporrorchis and Centrorhynchus) or in longitudinal rows (Prosthorhynchus), the proboscis receptacle id typically double layered in all of them, the cement glands are tubular pairs of two or three each (Parafilicollis, Prosthorhynchus, Centrorhynchus) or short follicular multinucleate glands (Filicollis) whereas the cement glands in typical Gigantorhynchidean or Archiacanthocephalan genera are typical uninucleate 8 discrete glandular follicles and are the most characteristic feature of that organization. The genus Pseudoacanthocephalus PETROCHENKO,1956 is almost identical with Acanthocephalus but has been differentiated from the latter by PETROCHENKO (1956) on the basis of embryonic spination only. But the patterns of spination which are given excessive importance by PETROCHENKO (1956) have not been found to be consistent within certain genera of a particular ordinal group and have not, therefore, been considered of such importance. Accordingly GRABDA-KAZUBSKA (1964) concluded that ".... the transfer of certain species of the genus Acanthocephalus to a new genus Pseudoacanthocephalus (due to cuticular spines on the embryo surface) and placing the latter in the subclass Gigantorhynchinea, or the transfer of Centrorhynchus and Filicollis to this subclass, are not justified."

Echinorhynchinea of PETROCHENKO (1956) is, however, a homogenous group and the classification of various families is quite appropriate. In the order Echinorhynchida, the family Echinorhynchidae has been classified into four subfamilies, viz. Echinorhynchinae, Hypoechinorhynchinae, Heteracanthocephalinae and Leptorhynchoidinae which were all, except the first of these, proposed as new subfamilies. But an analysis of the subfamilies indicates that the inclusion of certain genera in some of the subfamilies is incomatible. In Hypoechinorhynchinae, e.g. PETROCHENKO (1956) has included Hypoechinorhynchus YAMAGUTI,1939, Bolborhynchus ACHMEROV & DOMBROVSKAIA-ACHMEROVA,1941 (sic), Paracanthocephalus A. & D-A,1941 and Acanthocephaloides MEYER,1932. But within this subfamily, the concept of which is, and should be, formed around the type genus, none except the first conform with the basic concept.

The proboscis in Hypoechinorhynchus is oval or spherical and beset with three transverse rows of hooks disposed in apttern similar to one in Neoechinorhynchus whereas in the other genera including Acanthocephaloides the proboscis is usually elongated cylindrical and the hooks vary considerably in number and size; the posterior few becoming abruptly smaller in size. Consequently the remaining genera are untenable within this subfamily except Bolborhynchoides ACHMEROV,1959. The subfamily Heteracanthocephalinae also does not conform with the concept of Echinorhynchidae since the pattern of proboscis hooks is radically different in its constituent genera - Heteracanthocephalus PETROCHENKO,1956 and Sachalinorhynchus KROTOV & PETROCHENKO,1956 from those which otherwise typify Echinorhynchidae. In having a distinct dorso-ventral disparity in size in the proboscis hooks, the genera of Heteracanthocephalinae come closer to Aspersentidae from which they differ only in the absence of trunk spines. Heteracanthocephalinae has, therefore, been appropriately designated as an independent family - Heteracanthocephalidae by GOLVAN (1969).

Leptorhynchoidinae GOLVAN,1956 also offers distinct contrast with Echinorhynchidae; the nature of the lemniscis and the number of cement glands being two significant characters which differentiate between the two. The lemnisci are long, narrow and tubular in Leptorhynchoides species and the cement glands are constantly eight in number in L. thecatus (LINTON,1891) and also in L. plagicephalus (WESTRUMB,1821) whweras in all the genera belonging to Echinorhynchidae the lemnisci are short, fusiform occassionally half the length of proboscis receptacle except in *Acanthocephaloides* in which they are loger than the receptacle but consistently fusiform. The cement glands are always six in number and the hypodermal nuclei are small elliptical structures. The latter are characteristically large and dendritic in *Leptorhynchoides* and this can be reckoned as an important diagnostic character of considerable taxonomic significance. With these variations in view perhaps WITENBERG (1932) had created the family Leptorhynchoididae which probably escaped the notice of subsequent workers until GOLVAN (1969) resurrected it recently.

The organization of the order Polymorphida PETROCHENKO, 1956 too appears incoherent. The inclusion of families occuring in marine hosts chiefly, or a few found in fresh-water fishes along with those which are typical of avi-fauna or of large marine mammals is a syn-ecological disparity. The differences are manifested in somatic characters also. Polymorphida would have been more harmonius a group had it been restricted to Polymorphidae, Filicollidae, Prosthorhynchidae and Centrorhynchidae since they have closer affinities with each other and have probably evolved from a common ancestral stock but the inclusion of Rhadinorhynchidae, Telosentidae and the subfamily Serrasentinae within this order has made it a variegated group.

In Arhythmacanthidae, the first family of the Polymorphida, a notable inconsistency is marked. The constituent genera of this family are grouped into two subcategories by PETROCHENKO (loc. cit), *Arhythmacanthus*, *Heterosentis*, *Pseudoechinorhynchus*, *Aspersentis*, *Micracanthocephalus* (sic), *Hemirhadinorhynchus* and *Cleaveius* in one group which has not been demarcated and the genera *Polyacanthorhynchus* and *Protorhadinorhynchus* PETROCHENKO, 1956 which have been included in a new subfamily - Polyacanthorhychinae. Thus Arhythmacanthidae is retained with a single subfamily and in addition to it, with seven genera but with no type subfamily. Further, the genera *Heterosentis* and *Aspersentis* present an entirely different organization and have no compatibility with the other genera included in Arhythmacanthidae by PETROCHENKO (1956). The hook-pattern of *Arhthmacanthus fusiformis* YAMAGUTI, 1935, which happens to be the nominal type of the genus *Arhythmacanthus* YAMAGUTI, 1935 is entirely different from that in any other genus and this is one such typical and important character that genera not conforming with it could not be affiliated to the family itself. Subsequent authors (GOLVAN, 1960; YAMAGUTI, 1963) have, therefore, restricted Arhythmacanthidae to *Arhythmacanthus* and *Heterosentis* only but since the latter is more closely related to *Aspersentis* than to the former, it is transferred to Aspersentidae. *Heterosentis plotosi* YAMAGUTI, 1935 also belongs to *Arhythmacanthus* since it does not exhibit dorso-ventral differentiation of proboscis hooks, a condition characteristic of *Heterosentis*, but its proboscis armature resembles *Arhythmacanthus* pattern more closely since the apicals and basal hooks are smaller and those of the median row/s are comparatively much larger than the others. Hence this species is regarded a congener of *A. fusiformis* YAMAGUTI, 1935 and is proposed to be renamed as *Arhythmacanthus plotosi* (YAMAGUTI, 1935) n. comb., and *Paracanthocephaloides plotosi*, GOLVAN, 1969 is its junior synonym. The genus Cleaveius SUBRAHMANIAN,1927 has erroneously been assigned to Palaeacanthocephala , instead it is a nomen nudum since Cleaveius circumspinifer SUBRAHMANIAN,1927 is a Pallisentis species ; the single type specimen of this species is in a very unsatisfactory state of preservation and, therefore, its exact identity with any of the known species of the latter genus not feasible but the topography of its testes indicate its possible similarity with P. nagpurensis. The genus Micracanthocephalus , later renamed Micracanthorhynchina STRAND,1936, too does not belong to Arhthmacanthidae but has been designated as the nominal type of the family Micracanthorhynchinidae by YAMAGUTI (1963).

The subfamily Polyacanthorhynchinae PETROCHENKO,1956 is also untenable within Arhythmacanthidae; instead it desrves to be considered a distinct family. In having a single-layered pro[illegible] receptacle, long claviform proboscis with numerous longitudi[illegible] rows of hooks and in having eight cement glands, Polyacanthorhynchus presents an organization which does not conform with any other familial concept in the Palaeacanthocephala and has,therefore, been considered as a distinct family in the present study.

Rhadinorhynchidae has been divided into Rhadinorhynchinae and Serrasentinae, which PETROCHENKO (1956) has proposed as a new subfamily. The former contains the genera Rhadinorhynchus, Gorgorhynchus, Nipporhynchus and Tegorhynchus whereas the latter is monotypic and includes the genus Serrasentis only. The inclusion of Gorgorhynchus is, however, untenable since it markedly differs from other Rhadinorhynchid genera through its presomal organization and has since been designated as the nominal type of Gorgorhynchidae by VAN CLEAVE & LINCICOME (1940). The creation of Telosentidae by PETROCHENKO (1956) is appropriate and though recently BULLOCK & MATEO (1970) have suggested transfer of the genus Telosentis to the family Rhadinorhynchidae but the redescription of Telosentis exiguus by FLORESCU (1941) tends to affirm PETROCHENKO's view of its assignment to a separate family.

Polymorphidae sensu PETROCHENKO (1956) is, however, a grossly heterogenous group. This family has been classified by him into three families, viz. (a) Polymorphinae MEYER,1931 comprising the genera Polymorphus LUHE,1911, Hexaglandula PETROCHENKO,1956, Skrjabinorhynchus PETROCHENKO,1956 and Arhythmorhynchus LUHE,1911, (b) Corynosominae PETROCHENKO,1956, to include Corynosoma LUHE,1911 and Bolbosoma PORTA,1908 and (c) Palgirohynchinae MEYER,1931, emend. PETROCHENKO,1956 to accommodate Plagiorhynchus LUHE,1911, Lueheia TRAVASSOS,191, Oligoterorhynchus MONTICELLI,1914 and Sphaerechinorhynchus JOHNSTON,1929. The constitution of Polymorphinae is quite proper but Corynosominae and Plagiorhynchinae are not compatible with the concept of Polymorphidae and both represent distinct organizations. Corynosominae, as envisaged by PETROCHENKO (1956), is a natural group represented by the genera Corynosoma and Bolbosoma and occurring chiefly in aquatic mammals. Besides their host-preference, species of these two genera are morphologically distinct also and were aptly recognised to constitute the family Corynosomidae by

SOUTHWELL & MACFIE (1925). Corynosominae is cited as a new name by PETROCHENKO (1956) but it is untenable since the subfamily Corynosominae was proposed by WITENBERG (1932) much earlier though it was not endorsed by subsequent authors. MACHADO FILHO (1964) has created the subfamily Bolbosomatinae for the genus *Bolbosoma* and with this emendment in force, Corynosomatidae will comprise two subfamilies, (a) Corynosomatinae WITENBERG,1932, emend., with the genus *Corynosoma* LUHE,1911 as its type and (b) Bolbosomatinae, with the genus *Bolbosoma* PORTA,1908 as its nominal type.

Plagiorhynchinae MEYER,1931, emended PETROCHENKO,1956 comprised the genera *Plagiorhynchus* LUHE,1911, *Lueheia* TRAVASSOS,1919 *Oligoterorhynchus* MONTICELLI,1914 and *Sphaerechinorhynchus* JOHNSTON, 1929. All these genera are represented by species occurring in terrestrial birds and have their life-cycle patterns different from those which have been assigned to Polymorphidae. Morphologically they are distinguished from Polymorphidae in the absence of trunk spines and a distinct neck (which occurs in *Oligoterorhynchus* only). The closely related genus, *Prosthorhynchus* KOSTYLEW, 1915 has been assigned to the family Prosthorhynchidae and placed under the subclass Gigantorhynchinea, order Gigantorhynchida, mainly on the basis of the spination of embryo. *Prosthorhynchus* has recently been considered a synonym of the genus *Plagiorhynchus* by SCHMIDT & KUNTZ (1967) and this emendment would then render the family Prosthorhynchidae PETROCHENKO,1956 invalid and would also reflect upon the artificiality of of his scheme which is obviously more subjective than objective. The genera *Porrorchis* and *Pseudoporrorchis* have also been included in Prosthorhynchidae by PETROCHENKO (1956) but this is not acceptable to the any of the subsequent workers since these two genera are closer to Centrorhynchinae than to Prosthorhynchidae since they differ from Centrorhynchus in the absence of of spines on the neck only. Further, Pseudoporrorchis has also been declared a synonym of the genus Porrorchis by SCHMIDT & KUNTZ (1967) and has been relagated to the family Plagiorhynchidae.

GOLVAN (1960) adopted Meyer's (1932) and Van Cleave's (1936) views in elaborating the classification of Palaeacanthocephala which he divided into fifteen families. He has recognised the families : Diplosentidae TUBANGUI & MASILUNGAN, 1937, Gorgorhynchidae VAN CLEAVE & LINCICOME, 1940, Rhadinorhynchidae TRAVASSOS, 1923, Arhythmacanthidae YAMAGUTI, 1935, Echinorhynchidae COBBOLD, 1879, Cavisomidae MEYER, 1932, Fessisentidae VAN CLEAVE, 1931, Pomphorhynchidae YAMAGUTI, 1939, Polymorphidae MEYER, 1931, Pseudacanthocephalidae PETROCHENKO, 1956 (sic), and has proposed, as new families, Aspersentidae, Hypoechinorhynchidae, Paracanthocephalidae, Plagiorhynchidae and Centrorhynchidae.

Among these families GOLVAN (1960) subdivided Gorgorhynchidae into three subfamilies (a) Gorgorhynchinae, the nominal type, (b) Filisomatinae and (c) Serrasentinae; the first and second of these having been proposed as new subfamilies by him; Rhadinorhynchidae into (a) Illiosentinae GOLVAN, 1960, (b) Rhadinorhynchinae and (c) Leptorhynchoidinae; Echinorhynchidae into (a) Echinorhynchinae, (b) Neoacanthocephaloidinae ; Cavisomidae into (a) Vancleaveiinae GOLVAN, 1960 and Cavisomatinae; Polymorphidae into corynosominae and Polymorphinae; Plagiorhynchidae into Plagiorhinchinae, Porrorchinae and Sphaerechinorhynchinae GOVAN,1960. In devising this scheme GOLVAN (1960) much emphasised the number and nature of cement glands and paid secondary importance to such important characters as the pattern of trunk spines and the presomal organization. The majour part of the scheme is apt but some families merit a reconsideration. Plagiorhynchidae GOLVAN, 1967 has been accepted by SCHMIDT & KUNTZ (1967) but the inclusion of Porrorchinae within this family is not acceptable since Porrorchis has closer affinities with Centrorhynchus than with Plagiorhynchus and the subfamily Porrorchinae, as restricted with the removal of the genera Lueheia, Oligoterorhynchus and Pseudogordiorhynchus, is classified under the family Centrorhynchidae in the present study.

GOLVAN (1969) has recently published an extensive review of the superfamily Echinorhynchoidea GOLVAN & HOUIN,1963. In establishing this superfamily, GOLVAN (1969) assumes credit for introducing the concept of superfamilies in acanthocephalan heirarchy but this is not so; in fact suprafamilial groups were founded much earlier when RAUTHER (1930) had proposed the superfamily Echinorhynchoidea as a substitute for the subordinal group Echinorhynchata FAUST,1928.

In the revised taxonomy of Echinorhynchoidea and partly Palaeacanthocephala, GOLVAN (1969) retained almost all the same families which he had enumerated in his earlier scheme but reshuffled many subfamilies and genera considerably. He elevated the subfamilies Illiosentinae GOLVAN,1960 and Leptorhynchoidinae PETROCHENKO,1956 as families but suppressed Gorgorhynchidae VAN - CLEAVE & LINCICOME,1940, Cavisomatidae VAN CLEAVE,1931, and Aspersentidae GOLVAN,1960 to subfamilial ranks. He widened the scope of the family Illiosentidae by including the genera _Illiosentis_ VAN CLEAVE & LINCICOME, 1939, _Dollfusentis_ GOLVAN,1969, _Telosentis_ VAN CLEAVE, 1923, _Tegorhynchus_ VAN CLEAVE, 1921, _Metarhadinorhynchus_ YAMAGUTI, 1959, _Indorhynchus_ GOLVAN, 1969, _Pseudorhadinorhynchus_ ACHMEROV & DOMBROVSKAJA-ACHMEROVA,1941 and _Dentitruncus_ SINZAR,1955; all these being characterised by the possession of eight follicular cement glands, long slender lemnisci, and numerous rows of large cuticular spines on the fore-trunk.

Among the above mentioned genera, _Illiosentis_ and _Tegorhynchus_ have recently reviewed by BULLOCK & MATEO (1970) who have suggested that _Illiosentis_ and _Tegorhynchus_ are congeneric and that _Telosentis_ does not belong to Illiosentidae but to Rhadinorhynchidae since _Telosentis molini_ VAN CLEAVE,1923 and _T. exiguus_ (LINSTOW, 1901) are now known to possess four cement glands. This was not known previously and it was assumed that both these species possess eight cement glands. The third species, _Telosentis tenuicornis_ (LINTON,1891) was initially assigned to _Rhadinorhynchus_ but later on it has been considered a synonym of _Dollfusentis longispinus_ (CABLE & LINDEROTH,1963) GOLVAN 1969.

The genus _Indorhynchus_ GOLVAN,1969 has been created for _Rhadinorhynchus indicus_ TRIPATHI,1959 but the present author is obliged to consider it (the former) a synonym of the genus

Mehrarhynchus DATTA,1940. The writer has arrived at this conclusion after re-examining the type specimens of R. indicus TRIPATHI,1959 in which the number of cement glands is found to be six instead of eight as reported by the original author.

The genera Pseudorhadinorhynchus ACHMEROV & DOMBHOVSKAJA-ACHMEROVA,1941 and Dentitruncus SINZAR,1955 also appear congeneric. Both are essentially characterised by short cylindrical proboscis, spinose fore-trunk, long slender lemnisci and eight small follicular cement glands in the males. The former genus contains two species, P. markewitchi A & D-A,1941 and P. pseudaspii A & D-A,1941, the latter, only one, the Type, Dentitruncus truttae SINZAR,1955, and these three differe from each other in the number of proboscis hooks only. Further, these species form a distinct biological group since they all occur in fresh-water fishes of Palaearctic region whereas the remaining genera within Illiosentidae are essentially parasitic in marine hosts. Considering this close similarity between the two above mentioned genera, Dentitruncus is here considered a synonym of the genus Pseudorhadinorhynchus and D. truttae SINZAR,1955 is renamed as Pseudorhadinorhynchus - truttae (SINZAR,1955) comb. novo.

The other inconsistencies of GOLVAN's revised scheme are the inclusion of Gorgorhynchinae and Serrasentinae within Rhadinorhynchidae, of Aspersentinae in Heteracanthocephalidae, of Neoacanthocephaloidinae and Paracanthocephaloidinae in Arhythmacanthidae , of Yamagutisentinae GOLVAN,1969 in Echinorhynchidae, the merger of Cavisomatidae with Fessisentidae and the placement of Allorhadinorhynchinae in Diplosentidae. The genus *Polyacanthorhynchus* TRAVASSOS, 1926 and the subfamily Polyacanthorhynchinae PETROCHENKO, 1956 are notable omissions in that scheme. Likewise, the inclusion of *Filisoma* VAN CLEAVE, 1928 within Fessisentidae and of *Paracanthocephaloides* GOLVAN, 1969, *Euzetacanthus* GOLVAN & HOUIN, 1964 and *Breziacanthus* GOLVAN, 1969 in Arhythmacanthidae is incompatible because these genera do not conform with the basic concepts of the respective families to which they have been assigned to (GOLVAN, 1969: 13).

In formulating his scheme, GOLVAN (1969) has given over-emphasis to the number or cement glands, a character of considerable significance but of limited value since it is manifested in males only, but has given secondary importance to such consistent characters as the organization of the proboscis, pattern of proboscis hooks, form and extent of the lemnisci and trunk spination; characteristics are present in both sexes and are manifested since larval stages. It is essentially this view that has led GOLVAN (1969) to align spinose and aspinose genera under one family; ascribing trunk spination a subfamilial value in certain cases although in Eoacanthocephala trunk spination is has been considered a character of subordinal and occassionally of ordinal value.

It is, however, the conviction of the present author that the number or nature of cement glands is not a very significant dignostic character and the taxonomy of the acanthocephalans, which happen to be a formidable group of highly selective parasites, should essentially be based on somatic characters present in both sexes but these should be lent support by characters typical of either sex as well such as the nature of cement glands, their form - syncytial, follicular or tubular, the nature of ligament sacs and of eggs, particularly modifications or ornamentation of their inner shells and the shape and position of testes. Further, these characters should also be blended with synecological considerations since a good number of acanthocephalan genera are distinctly 'group specific' and do not attain maturity in hosts belonging to lower phylogenetic rungs. Centrorhynchus, Bolbosoma, Moniliformis, Gigantorhynchus and Macracanthorhynchus are some of the most significant examples in this regard; species belonging to the genus Centrorhynchus parasitize birds, of Bolbosoma occur in Cetaceans, of Moniliformis in rodents only whereas Macracanthorhynchus species have been recorded from higher mammals, mainly the ungulates and Oncicola species are restricted to the Fissipedia only.

YAMAGUTI (1963) also has based his scheme on the lines of SOUTHWELL & MACFIE (1925) and partly on those of PETROCHENKO (1956) since he has recognised the same four ordinal categories which the former authors have designated, viz. Apororhynchidea, Neoechinorhynchidea, Echinorhynchidea and Gigantorhynchidea. The order Palaeacanthocephala has been equated with Echinorhynchidea and partly shared by Gigantorhynchidea since three Palaeacanthocephalan families, Centrorhynchidae, Prosthorhynchidae and Pseudacanthocephalidae have been placed within the latter order.

In Echinorhynchidea, YAMAGUTI (1963) has retained the same ten families which PETROCHENKO (1956) has done except the family Micracanthorhynchinidae which YAMAGUTI (1963) has proposed as a new one. He has classified the various families essentially on the basis of trunk spination, its presence or absence and further on the basis of the form of testes, neck and cement glands. Arhthmacanthidae, Aspersentidae, Diplosentidae, Fessisentidae and Filicollidae are smaller groups and have not be subdivided, each containing a few genera only (details cited on page 160-163 of his treatise - Systema Helminthum, Vol. V) but Echinorhynchidae, Polymorphidae and Rhadinorhynchidae are among the larger families which have been divided into five, two and f ur subfamilies, respectively. Echinorhynchidae comprises Cavisomatinae, Echinorhynchinae, Heteracanthocephalinae and Hypoechinorhynchinae although the latter two are untenable since they do not agree with the rational concept of Echinorhynchidae essentially on the basis of presomal organization. Each is too distinct to be recognised as a family; in fact PETROCHENKO (1956) has aptly done so but YAMAGUTI (loc. cit) has disapproved of that arrangement and has made Echinorhynchidea quite a heterogenous group. Filisoma, Heteracanthocephalus and Hypoechinorhynchus reflect upon the diversity which has been been sustained by Echinorhynchidae.

Rhadinorhynchidae is comprised of all the spinose genera which occur in marine fishes as also some in fresh-water hosts. The family is divided into five subfamilies, viz, Illiosentinae, comprising Illiosentis and Telosentis; Polyacanthorhynchinae, including Polyacanthorhynchus and Protorhadinorhynchus; Rhadinorhynchinae containing Allorhadinorhynchus, Gorgorhynchus, Mehrarhynchus, Metarhadinorhynchus, Nipporhynchus, Paragorgorhynchus, Raorhynchus, Rhadinorhynchus and Tegorhynchus, and the subfamily Serrasentinae which is monotypic and comprises the genus Serrasentis only.

Palgiorhynchidae is classified into Plagiorhynchinae and Sphaerechinorhynchinae; the former embracing the genera Plagiorhynchus, Lueheia, Oligoterorhynchus and Pseudogordiorhynchus and the latter, Sphaerechinorhynchus only but Prosthorhynchus, which is so closely related to Plagiorhynchus that it has even been considered its synonym (SCHMIDT & KUNTZ,1967) , or its nearest congener (TADROS,1969,1971), Porrorchis and Pseudoporrorchis which differ from Lueheia in the number of lemniaci only, have been placed in a different order - the Gigantorhynchidea. Centrorhynchidae, with the genus Centrorhynchus and Pseudoacanthocephalidae with the genus Pseudoacanthocephalus have also been included within the same order, i.e. Gigantorhynchidea.

These three families have been relegated to Gigatorhynchidea for no convincing reasons; PETROCHENKO (1956) had essentially taken into account the the pattern of spines on the embryo and the non-invaginability of the proboscis as principal diagnostic characters of his sub-class Gigantorhynchinea and had surmised that the embryo of the species belonging to the above mentioned families are of the holoechine type and that the proboscis is permanently in the everted condition but either condition is inconsistent, variable or even unknown in many genera. Consequently Petrochenko's (1956) and Yamaguti's (1963) assertion regarding the assignment of the families Centrorhynchidae, Prosthorhynchidae and Pseudoacanthocephalidae to the order Gigantorhynchidea, which, barring these three families, is an equivalent of the order Archiacanthocephala, seems unjustified. The characterization of Eoacanthocephala, Palaeacanthocephala and Archiacanthocephala, as envisaged by MEYER (1931,1932), VAN CLEAVE (1936) and GOLVAN (1959,1960,1964,1969), therefore, appears more appropriate and acceptable though a re-evaluation in context with the incompatibilities mentioned in the foregoing account is warrented.

Accordingly the order Palaeacanthocephala MEYER,1931, emend. VAN CLEAVE,1936 is classified into the following twenty-four families :

(1) Diplosentidae TUBANGUI & MASILUNGAN, 1937 :

This family was originally created to accommodate the type genus, Diplosentis TUBANGUI & MASILUNGAN,1937 only. Both, the family,as well as the genus, were characterised by the presence of two elongated cement glands and smooth aspinose trunk with short cylindrical proboscis and relatively few longitudinal rows of hooks. GOLVAN (1960) transferred the genus Pararhadinorhynchus JOHNSTON & EDMONDS, 1947 to this family since this genus is also characterised by the presence of two elongate tubular cement glands, aspinose trunk and a relatively longer proboscis with eighteen longitudinal rows of hooks in *P. mugilis* JOHNSTON & EDMONDS,1947 - the type of the genus. Later on, GOLVAN (1969) divided this family into two subfamilies, (a) Diplosentinae GOLVAN & HOUIN,1963, comprising *Diplosentis* and *Pararhadinorhynchus* and (b) Allorhadinorhynchinae GOLVAN, 1969, to include the genus *Allorhadinorhynchus* YAMAGUTI,1959 which also possesses two cement glands but differs from the other Diplosentid genera by having pseudosegmented trunk beset with cuticular spines laid in transverse rows in the anterior 1/3 of the trunk. This proposal is not acceptable to the present writer. *Allorhadinorhynchus segmentatum* YAMAGUTI,1959 is a typical Rhadinorhynchid species and its presomal anatomy and spinose nature of the trunk indicate its closer affinities with Rhadinorhynchidae than Diplosentidae which should better be restricted to aspinose genera with two long tubular cement glands in their constituent species.

Consequently Allorhadinorhynchinae is withdrawn from Diplosentidae and is relegated to Rhadinorhynchidae and the former family is restricted to the genera *Diplosentis* TUBANGUI & MASILUNGAN,1937 - the type genus, and *Pararhadinorhynchus* JOHNSTON & EDMONDS,1947. The subfamily Diplosentinae GOLVAN & HOUIN,1963 no more remains necessary and is, therefore, deleted by regarding it a category equivalent in content to Diplosentidae sensu TUBANGUI & MASILUNGAN,1937.

(2) Family Acanthodeltidae , new family :

This family is proposed to accommodate the genus Acanthodelta DIAZ-UNGRIA & GRACIA RODRIGO,1958 - the nominal type. This genus was originally assigned to the family Quadrigyridae by DIAZ-UNGRIA & GRACIA RODRGIO (1957,1958) and was treated as an 'appendix to Acanthogyridae' by YAMAGUTI (1963) but a re-examination of the holotype of Acanthodelta scorzai DIAZ-UNGRIA & RODRIGO,1958 reaffirms that Acanthodelta is a Palaeacanthocephalan genus and since it does not fit in any of the families, Acanthodeltidae is created for its reception. The family is zoogeographically distinguished as a Neotropical group. The family, as well as the genus, both, are monotypic.

(3) Family Gorgorhynchidae VAN CLEAVE & LINCICOME,1940:

This family was constituted around the concept of the genus Gorgorhynchus CHANDLER,1934 which is characterised by elongated spinose trunk, short cylindrical or claviform proboscis with numerous longitudinal rows of hooks, not exhibiting any structural differentiation, elongated, tubular, slender lemnisci longer than the proboscis receptacle and four long tubular cement glands. In addition to Gorgorhynchus, another genus, Nipporhynchus CHANDLER, 1934 was also included within Gorgorhynchidae by its original authors. PETROCHENKO (1956) discarded this family and assigned these two genera, Gorgorhynchus and Nipporhynchus, to the subfamily Rhadinorhynchinae of the family Rhadinorhynchidae. GOLVAN (1960) first maintained this family and classified it into three subfamilies : (a) Gorgorhynchinae GOLVAN,1960, with the genera Gorgorhynchus CHANDLER,1934, Paragorgorhynchus GOLVAN,1957, Mehrarhynchus DATTA,1940 and Hipporhynchus CHANDLER,1934 ; (b) Filisomatinae GOLVAN,1960, with the genera Filisoma VAN CLEAVE, 1928, Rhadinorhynchoides FUKUI & MORISHITA,1937 and Neogorgorhynchus GOLVAN,1960, and (c) Serrasentinae PETROCHENKO,1956, with the sole genus, Serrasentis VAN CLEAVE,1923. Later, in 1964, he removed Filisomatinae from Gorgorhynchidae and, instead, placed Fessisentinae within the latter. Subsequently, he (GOLVAN,1969) he suppressed it as the subfamily Gorgorhynchinae VAN CLEAVE & LINCICOME,1940 (sic) and included it in the family Rhadinorhynchidae.

YAMAGUTI (1963) also regarded Gorgorhynchinae a subfamily of Rhadinorhynchidae and and eventually synonimised the former with Rhadinorhynchinae which included the genera : Rhadinorhynchus LUHE,1911, Gorgorhynchus CHANDLER,1934, Hipporhynchus CHANDLER,1934, Tegorhynchus VAN CLEAVE,1921, Mehrarhynchus DATTA,1940, Paragorgorhynchus GOLVAN,1957, Allorhadinorhynchus YAMAGUTI,1959 and Metarhadinorhynchus YAMAGUTI,1959 and at the same time declared Mesacanthorhynchus MORISHITA,1937 a junior synonym of Gorgorhynchus.

The present writer does not submit to the views of Yamaguti who has rendered Rhadinorhynchidae a heterogenous group by overlooking some of the most significant diagnostic features. This author also disagrees with GOLVAN (1969) in regarding Gorgorhynchinae a subfamily of Rhadinorhynchidae. The nature of the proboscis and the presomal organozation is unquestionably the most consistent feature which can be utilised as a diagnostic character for Gorgorhynchid and Rhadinorhynchid genera. The proboscis is typically short, cylindrical or claviform in Gorgorhynchidae and the proboscis hooks are almost uniform and are neither differentiated in size dorso-ventrally nor do they form the basal corona radiata; secondly the lemnisci are typically slender and are much longer than the proboscis receptacle. The cement - glands carry secondary importance in this case; however, they are long, tubular and are always four in number. Conversely, in Rhadinorhynchidae, the proboscis is comparatively long and slender and the proboscis hooks are characteristically differentiated dorso-ventrally in shape and size and form a distinct complete corona radiata of largest hooks at the base of the proboscis. The trunk spines are either small and uniformly distributed over the fore-trunk or, are large and randomly scattered over the antero-ventral surface of the fore-body. The lemnisci are distinctly smaller, usually half the length of the proboscis receptacle.

Consequently Gorgorhynchidae appear as a distinct and natural group of parasites distinguished from Rhadinorhynchidae, their nearest allies through the characters mentioned above. The family accordingly comprises the following genera which conform with the concept as enunciated by VAN CLEAVE & LINCICOME (1940) : Gorgorhynchus CHANDLER,1934, the nominal type; Gorgorhynchoides CABLE & LINDEROTH,1963; Pseudauchen YAMAGUTI,1963 (which has been erroneously considered a synonym of Gorgorhynchus by GOLVAN,1969) and <u>Furtadosentis</u> n.gen.

The genus <u>Furtadosentis</u> is being proposed here to contain <u>Gorgorhynchus ophiocephali</u> FURTADO & CHAU-LAN,1971, which,otherwise is untenable within its original genus and differs from it markedly in having an oblong proboscis, a distinct aspinose neck and in having regional differentiation in the size of proboscis hooks. The diagnosis of the genus is as follows :

<u>Furtadosentis n. gen</u>.

Gorgorhynchidae; body elongated, cylindrical, trunk spinose, with a few transverse rows of sheathed spines projecting only a little from the cuticle. Proboscis oblong, profusely spinose, anterior hooks larger, median hooks smaller than the posterior ones. Neck smooth, aspinose, half as long as the proboscis; proboscis receptacle many times longer; cerebral ganglion in its anterior middle. Lemnisci tubular, longer than the proboscis receptacle, extending well upto the anterior testis. Cement glands 4, elongate tubular, commencing immediately from behind the posterior testis. Cement reservoir present; formed by the proximal confluence of cement ducts. Eggs fusiform with polar projections in the middle shell. Parasites of fresh-water fishes. Distribution: Malaysia.- Type species : <u>Furtadosentis ophiocephali</u> (FURTADO & - CHAU-LAN,1971) comb. nov. - monotypic.

(4) *Family Rhadinorhynchidae TRAVASSOS, 1923* :

Originally it was proposed as the subfamily Rhadinorhynchinae by LUHE (1911) but was later recognised as the family Rhadinorhynchidae by TRAVASSOS (1923) who included within this group the genera *Rhadinorhynchus* LUHE,1911 and *Polyacanthorhynchus* TRAVASSOS,1920. Subsequently, the same author (TRAVASSOS,1926) elaborated the family and ascribed to it the genera *Serrasentis* VAN CLEAVE,1923, *Telosentis* VAN CLEAVE,1923, *Tegorhynchus* VAN - CLEAVE,1921 and *Leptorhynchoides* KOSTYLEW,1924 in addition to the two genera previously included within (TRAVASSOS,1923). Meyer (1932) accepted it as such and assigned two more genera, *Cleaveius* SUBRAHMANIAN,1927 and *Filisoma* VAN CLEAVE,1928 to this family although the latter genus was accommodated within the family Filisomidae by VAN CLEAVE (1928) but Meyer (1931,1932) did not approve of it.

CHANDLER (1934) considered *Rhadinorhynchus* (s.l) as a complex group and carved out of it three genera, viz, *Rhadinorhynchus* LUHE,1911 (s.s), *Gorgorhynchus* CHANDLER,1934 and *Hippo-rhynchus* CHANDLER,1934. VAN CLEAVE & LINCICOME (1940) re-organised Rhadinorhynchidae and divided it into two subfamilies, mainly on the basis of the number and nature of cement glands, as (a) Rhadinorhynchinae LUHE,1911, containing *Rhadinorhynchus*, *Illiosentis* VAN CLEAVE & LINCICOME,1939, *Telosentis*, *Tegorhynchus*, *Polyacanthorhynchus* and *Leptorhynchoides*, all characterised by the presence of eight cement glands, and (b) Gorgorhynchinae, comprising *Gorgorhynchus*, *Aspersentis*, *Serrasentis* and *Filisoma*.

all having four cement glands in their species. PETROCHENKO (1956) created the subfamily Serrasentinae for the genus *Serrasentis* and assigned the former to Rhadinorhynchidae along with the nominal type, Rhadinorhynchinae. He, however, shifted the genera *Polyacanthorhynchus*, *Telosentis* and *Illiosentis* to other families; the first of these to Arhythmacanthidae and the latter two genera to Telosentidae, which he proposed as a new family. For *Rhadinorhynchus ditrematis* YAMAGUTI,1939 and *R. carangis* YAMAGUTI,1939, he proposed the genus *Protorhadinorhynchus* and assigned it to the subfamily Polyacanthorhynchinae PETROCHENKO,1956 since both these species have single layered proboscis receptacle, a condition similar to *Polyacanthorhynchus*.

In the meanwhile, TRIPATHI (1959) described the genus *Raorhynchus* and created the family Raorhynchidae to accommodate that genus. YAMAGUTI (1963) considered the latter synonymous with Rhadinorhynchidae and suppresed Illiosentidae GOLVAN,1960 and Gorgorhynchidae VAN CLEAVE & LINCICOME,1940 also. YAMAGUTI (1963) expanded Rhadinorhynchidae and classified it into four subfamilies, viz. (a) Rhadinorhynchinae, (b) Illiosentinae, (c) Polyacanthorhynchinae and (d) Serrasentinae. He diversified Rhadinorhynchidae considerably and that resulted in confusion.

GOLVAN (1969) emended the concept of Rhadinorhynchidae by restricting it genera with four cement glands and spinose trunk and accordingly classified it into three subfamilies, viz. (a) Rhadinorhinchinae, with *Rhadinorhynchus*, *Raorhynchus*, *Megistacantha* GOLVAN,1960, *Cathyacanthus* GOLVAN,1969 and *Paragorgorhynchus*.

(b) Gorgorhynchinae, with <u>Gorgorhynchus</u>, <u>Cleaveius</u>, <u>Micracanthorhynchina</u> and <u>Australorhynchus</u> and (c) Serrasentinae, to include <u>Serrasentis</u> only. The genus <u>Micracanthorhynchina</u> has previously been assigned to the family Micracanthorhynchinidae by YAMAGUTI (1963) whereas <u>Cleaveius</u> SUBRAHMANIAN,1927 has bee regarded by GOLVAN (1969) the senior synonym of the genus <u>Mehrarhynchus</u> DATTA, 1940 but this is an anomaly since <u>Cleaveius</u> is a nomen nudum. <u>Gorgorhynchus</u> and <u>Australorhynchus</u> do not conform with the concept of Rhadinorhynchidae and are no more tenable in that family. Instead, they have closer affinities with Gorgorhynchidae and have,therefore, been assigned to that family. The genus <u>Serrasentis</u> too is untenable within Rhadinorhynchidae; its cuticular modifications are so distinct that its species stand out differently from all other rhadinorhynchid genera. The subfamily Serrasentinae warrents recognition as an independent family.

The genus <u>Nipporhynchus</u> CHANDLER,1934 has also been regarded a synonym of <u>Rhadinorhynchus</u> but the present author does not concur with this view. These two genera are of course closely related but are distinguished from each other through the typical pattern of trunk spination which comprises close-set rows of minute spines uniformly distributed over the fore-trunk, more so ventrally than dorsally in <u>Nipporhynchus</u>, but in <u>Rhadinorhynchus</u> species, the trunk spines are relatively few,large; exceedingly larger in <u>Megistacantha</u> GOLVAN,1960, as recently verified by KHALIL (1969), and randomly scattered over a a restricted region on the fore-trunk.

Hence, essentially on the basis of trunk spination, the genus _Nipporhynchus_ CHANDLER,1934 is revalidated and the following species are retained under this genus :

(i) _Nipporhynchus katsuwonis_ HARADA,1938 ; the nominotype,
(ii) _Nipporhynchus trachuri_ HARADA,1938
(iii) _Nipporhynchus seriolae_ YAMAGUTI,1963
(iv) _Nipporhynchus polynemi_ (TRIPATHI,1959) n. comb.,
(v) _Nipporhynchus africanus_ GOLVAN & HOUIN,1963
(vi) _Nipporhynchus cadenati_ GOLVAN & HOUIN,1964
(vii) _Nipporhynchus atheri_, n. sp.

The genus _Rhadinorhynchus_ LUHE,1911, as characterised above, and restricted with the removal of the two species, _R. horridus_ LUHE,1911 and _R. exilis_ VAN CLEAVE,1928, to the genera _Megistacantha_ GOLVAN,1960 and _Cathyacanthus_ GOLVAN,1969,respectively, comprises the following species :

(i) _Rhadinorhynchus pristis_ LUHE,1911, nominal type,
(ii) _Rhadinorhynchus selkirki_ VAN CLEAVE,1921,
(iii) _Rhadinorhynchus japonicus_ FUJITA,1920
(iv) _Rhadinorhynchus ornatus_ VAN CLEAVE, 1918,
(v) _Rhadinorhynchus cololaibis_ LAURS & McCAULEY,1964,
(vi) _Rhadinorhynchus johnstoni_ : GOLVAN,1969
(vii) _Rhadinorhynchus lintoni_ CABLE & LINDEROTH, 1963,
(viii _Rhadinorhynchus tenuicornis_ (LINTON,1891)
(ix) _Rhadinorhynchus camerounensis_ GOLVAN,1969, and
(x) _Rhadinorhynchus dujardini_ GOLVAN,1969.

Various authors have reviewed and reorganised the genera of Rhadinorhynchidae but have invariably based their decisions on the structural organization of cement glands; CHANDLER (1934) characterised the Rhadinorhynchus with eight cement glands and the other two genera, <u>Gorgorhynchus</u> and <u>Nipporhynchus</u> with four such glands. GOLVAN (1960) also characterised Rhadinorhynchidae with eight cement glands and essentially on this basis he aligned Illiosentinae and Leptorhynchoidinae with Rhadinorhynchinae under Rhadinorhynchidae since the constituent species belonging to these three families have been reported to possess eight cement glands; the first two have spinose trunks and the third one is represented by aspinose genera. However, two more significant characters which are manifested in both sexes, viz, the arrangement and nature of proboscis hooks and the extent of the lemnisci, have been bypassed by them.

A comparative study of the various species belonging to the genera <u>Rhadinorhynchus</u>, <u>Nipporhynchus</u>, <u>Gorgorhynchus</u> , <u>Illiosentis</u> and <u>Leptorhynchoides</u> indicate that the proboscis hooks exhibit typical dorso-ventral differentiation in the species belonging to the first two, and also in <u>Allorhadinorhynchus</u> and the posterior-most hooks (of the last circle) form a complete circle of larger radiating hooks - the corona radiata, whereas in <u>Gorgorhynchus</u>, and in other genera assigned to Gorgorhynchidae, the hooks are alike all over the proboscis and gradually decrease in size antero-posteriorly but never give rise to the corona at the base of the proboscis. In Illiosentis and Dollfusentis the proboscis is fairly long and slender as in Rhadinorhynchus but the corona radiata is characteristically incomplete, the larger hooks being present in a crescent ventrally only. The lemnisci are spatulate and shorter, usually half as long as *the proboscis receptacle in all the species of* Rhadinorhynchus, Nipporhynchus and Allorhadinorhynchus and this is a consistent feature whereas in Gorgorhynchus and other genera belonging to Gorgorhynchidae and also in Illiosentis, Dollfusentis, Metarhadinorhynchus they are typically long, slender, tubular and extend far beyond the proboscis receptacle. The number of cement glands as eight in Rhadinorhynchus has almost become a myth since in none of its species it has ever been found to be so; instead the number is now recognised as four in Rhadinorhynchidae as well as in Gorgorhynchidae whereas Illiosentidae is characterised by species with eight discrete cement glands.

With these characters and criteria in view the family Rhadinorhynchidae is re-organised and is classified into the following two subfamilies and corresponding genera :

(a) Subfamily Allorhadinorhynchinae GOLVAN,1969

(i) Genus Allorhadinorhynchus YAMAGUTI, 1959; Nominotype.

(b) Subfamily Rhadinorhynchinae LUHE,1911

(i) Genus Rhadinorhynchus LUHE,1911 , nominal type.

(ii) Genus Nipporhynchus CHANDLER,1934

(iii) Genus Megistacantha GOLVAN,1960

(iv) Genus Cathyacanthus GOLVAN, 1969

(v) Genus *Paragorgorhynchus* GOLVAN, 1957

The subfamilies Illiosentinae, Polyacanthorhynchinae and Serrasentinae, previously included within Rhadinorhynchidae by YAMAGUTI (1963) and by GOLVAN (1969) are recognised as independent families.

(5) Family Illiosentidae GOLVAN, 1960 :

Originally proposed as a subfamily under Rhadinorhynchidae by GOLVAN (1960), it was elevated to the rank of a family by the same author in 1969. Illiosentinae GOLVAN, 1960 comprised the genera Illiosentis VAN CLEAVE & LINCICOME, 1939 and Telosentis VAN CLEAVE, 1921 and the subfamily was characterised by the presence of cuticular spines on the fore-trunk as well as around the genital orifice but the latter character has not been found to be consistent (EDMOND, 1964; BULLOCK & MATEO, 1970). The number and nature of cement glands, however, carry sufficient diagnostic value at supra-generic level in this case and the family, Illiosentidae, is thus characterised by eight small follicular glands with long ducts, elongate proboscis without dorso-ventral differentiation in size of hooks, spinose fore-trunk, incomplete corona-radiata and long slender lemnisci. The presence or absence of genital spines has been considered a character of generic value by GOLVAN (1969) who has diffrentiated Dollfusentis GOLVAN, 1969 from Illiosentis VAN CLEAVE & LINCICOME, 1939 essentially through the absence of genital spines in the former and their presence and the occurrence of a muscularised fan-shaped organ at the posterior extremities in males and in females also in *Illiosentis*. YAMGUTI (1963) has retained these two genera , i.e. *Illiosentis* and *Telosentis* only in Illiosentinae but GOLVAN (1969) has assigned to Illiosentidae the following nine genera :

(i) *Illiosentis* VAN CLEAVE & LINCICOME, 1939,
(ii) *Dollfusentis* GOLVAN, 1969
(iii) *Telosentis* VAN CLEAVE, 1923
(iv) *Pseudorhadinorhynchus* ACHMEROV & DOMBROVSKAIA, 1941
(v) *Tegorhynchus* VAN CLEAVE, 1921
(vi) *Metarhadinorhynchus* YAMAGUTI, 1959
(vii) *Indorhynchus* GOLVAN, 1969, and
(viii) *Dentitruncus* SINZAR, 1955.

Among these genera, *Tegorhynchus* and *Dentitruncus* are not adequately known; *Tegorhynchus* is a relict genus and is represented by only two species, *Tegorhynchus brevis* VAN CLEAVE, 1921 from Juan-Fernandez, Chile and *Tegorhynchus pectinarius* VAN CLEAVE, 1940 from Puerto-Culebra, Costa Rica. BULLOCK & MATEO (1970), on the basis of some material pertaining to *T. brevis* from Colombia, have regarded *Tegorhynchus* as a senior synonym of *Illiosentis* and have indicated that *T. pectinarius* belongs to a different genus which they intended to describe subsequently. If this synonymy is accepted the species belonging to Illiosentis will be transferred to *Tegorhynchus* as new combinations but the family Illiosentidae will be conserved in accordance with Article 40. However, the present writer refrains from these emendments till detailed accounts of the species and genera concerned are published by BULLOCK & MATEO (op. cit).

Among the nine genera which GOLVAN (1969) has placed in Illiosentidae, *Pseudorhadinorhynchus* and *Dentitruncus* are the only taxa which comprise species from fresh-water hosts; remaining genera are described from marine fishes exclusively. However, the two, i.e. *Pseudorhadinorhynchus* and *Dentitruncus* are almost similar and can hardly be differentiated from each other. The former is an isotypic genus and contains two species, *P. markewitchi* ACHMEROV & DOMBROVSKAJA-ACHMEROVA, 1941 and *P. pseudaspii* A & D-A, 1941 whereas *Dentitruncus* SINZAR, 1955 is monotypic and is represented by *D. truttae* SINZAR, 1955, the nominal type. In view of this close similarity between the two genera, *Dentitruncus* SINZAR, 1955 is considered a junior synonym of *Pseudorhadinorhynchus* A & D-A, 1941 and the type species of the former is renamed as *Pseudorhadinorhynchus truttae* (SINZAR, 1955) n. comb.

The genus *Dollfusentis* GOLVAN, 1969 has been validated by BULLOCK & MATEO (1970) but they have pronounced its type species, *Dollfusentis chandleri* GOLVAN, 1969 an objective synonym of *Dollfusentis longispinus* (CABLE & LINDEROTH, 1963) GOLVAN, 1969 which eventually becomes its type by implication. The genus *Indorhynchus* GOLVAN, 1969 has already been stated to be synonym of the genus *Mehrarhynchus* DATTA, 1940 and with these emendments in effect, the family Illiosentidae is confined to the following genera :

(i) Genus <u>Illiosentis</u> VAN CLEAVE & LINCICOME, 1939

(ii) Genus <u>Dollfusentis</u> GOLVAN, 1969

(iii) Genus <u>Telosentis</u> VAN CLEAVE, 1923

(iv) Genus <u>Tegorhynchus</u> VAN CLEAVE, 1921

(v) Genus <u>Metarhadinorhynchus</u> YAMAGUTI, 1959

(vi) Genus <u>Pseudorhadinorhynchus</u> A & D-A, 1941.
(= <u>Dentitruncus</u> SINZAR, 1955) - syn. hoc loco.

(6) <u>Family Serrasentidae PETROCHENKO, 1956, n. grad</u>.

Serrasentidae was also initially proposed as a subfamily under Rhadinorhynchidae by PETROCHENKO (1956). Serrasentinae PETROCHENKO, 1956 was montypic and contained the type genus, <u>Serrasentis</u> only. But <u>Serrasentis</u> VAN CLEAVE, 1923 does not agree with the concept of Rhadinorhynchidae since marked differences are encountered in the basic concepts of the two. The proboscis organization of <u>Serrasentis</u> is remarkably different from the one in Rhadinorhynchidae; the proboscis of <u>Serrasentis</u> <u>socialis</u> (LEIDY, 1851), the type species of the genus concerned, is short, stout, broad claviform and the hooks are alike lacking any dorso-ventral differentiation. The lemnisci are elongated, slender and much longer than the proboscis receptacle. The corona radiata of basal hooks, a characteristic feature of Rhadinorhynchidae, is also wanting in <u>Serrasentis</u>. Further, the trunk spines are restricted to a few approximated circular rows anteriorly and are followed by numerous typical pectinate cuticular modifications or 'combs' which are characteristic enough to distinguish Serrasentis from any other Palaeacanthocephalan genus. Consequently, in view of such distinct structural peculiarities in its constituent species, Serrasentidae is recognised as a distinct family which, otherwise, as a subfamily, did not conform with the concept of either Gorgorhynchidae, as proposed earlier by GOLVAN (1960) or Rhadinorhynchidae, as postulated by YAMAGUTI (1963) and GOLVAN (1969). The family is monotypic and contains the type genus, Serrasentis VAN CLEAVE,1923, only.

(7) Family Polyacanthorhynchidae PETROCHENKO,1956, n. grad.

This family comprises only two genera, viz, Polyacanthorhynchus TRAVASSOS,1920 and Protorhadinorhynchus PETROCHENKO,1956, characterised by possessing single-layered proboscis receptacle, long cylindrical, profusely uncinated proboscis, longer lemnisci, spinose fore-trunk and four to eight cement glands. The most distinguishing feature is the single-layered nature of the proboscis receptacle which is an exception among the Palaeacanthocephala.

PETROCHENKO (1956) and YAMAGUTI (1963) have maintained it as the subfamily Polyacanthorhynchinae PETROCHENKO,1956 under Rhadinorhynchidae but the present author deems it proper to raise it as a distinct family; differentiated from the remaining collateral families through the characteristics discussed above. The family comprises the same two genera ascribed to it by PETROCHENKO (1956), i.e. Polyacanthorhynchus TRAVASSOS,1920 - the type genus, and Protorhadinorhynchus PETROCHENKO,1956.

are relatively larger in size. The present writer, therefore, agrees with GOLVAN (1969) in assigning Pseudorhadinorhynchus to Illiosentidae but does not agree with him in discarding the family Micracanthorhynchinida which is hereby retained with the following genera :

(i) Genus Micracanthorhynchina (HARADA,1935) - Type,
(ii(Genus Mehrarhynchus DATTA,1940
(iii) Genus Neoacanthocephaloides CABLE & QUICK,1954
(iv) Genus Yamagutisentis GOLVAN,1969
(v) Genus Paracanthorhynchus EDMONDS,1967

GOLVAN (1969) has considered Mehrarhynchus as a synonym of Cleaveius but this has already been discarded since Cleaveius is a nomen nudum; Mehrarhynchus DATTA,1940 is resurrected and retained within Micracanthorhynchinidae. Neoacanthocephaloides, Yamagutisentis and Paracanthorhynchus are also included within this family since all these three genera entirely conform with the diagnosis of Micracanthorhynchinidae YAMAGUTI,1963. The subfamily Yamagutisentinae GOLVAN,1969 is untenable within Echinorhynchidae and the subfamily itself becomes consonant with Micracanthorhynchinidae and is, therefore, deleted. Neoacanthocephaloides has been placed by GOLVAN (1969) in the subfamily NeoacanthocephaloidinaeGOLVAN,1969 of the family Arhythmacanthidae but this subfamily also becomes redundant in the present context since it also agrees with the contents of Micracanthorhynchinidae. Paracanthorhynchus was assigned to subfamily Vancleaveinae GOLVAN,1960 of the family Cavisomatidae but this assignment is untenable, firstly because the subfamily Vancleaveinae GOLVAN,1960 is invalid (its orthography is contrary to Article 29) and secondly could not belong to Cavisomatidae since the trunk is spinose in Paracanthorhynchus whereas in Cavisomatidae the trunk lacks spines, and this is an important differential character. Paracanthorhynchus EDMONDS,1967 hence belongs to Micracanthorhynchinidae.

(9) Family Arhythmacanthidae YAMGUTI,1935

This family was proposed by YAMAGUTI (1935) to accommodate the genera Arhytmacanthus YAMAGUTI,1935, the nominal type, and Heterosentis VAN CLEAVE,1931, essentially based on the pattern of proboscis hooks which are largest in the middle, small in the apical region and still smaller in the posterior proboscis-region. The trunk spines are confined to the anterior quarter of the metasoma.

GOLVAN (1969) has diversified this family by classifying it into three subfamilies, viz. (a) Arhythmacanthinae YAMAGUTI,1935, containing Arhythmacanthus YAMAGUTI,1935 and Gorgorhynchoides CABLE & LINDEROTH,1963, (b) Neoacanthocephaloidinae GOLVAN,1960, having Neoacanthocephaloides CABLE & QUICK,1954 and Acanthocephaloides MEYER,1932 and (c) Paracanthocephaloidinae GOLVAN,1969 comprising Paracanthocephalorhynchoides GOLVAN,1969, Euzetacanthus GOLVAN & HOUIN,1964 and Breziacanthus GOLVAN,1969.

(10) <u>Family Aspersentidae GOLVAN,1960, and</u>

(11) <u>Family Heteracanthocephalidae PETROCHENKO,1956</u>

These two families are characterised by forms having distinct dorso-ventral differentian in proboscis hooks; those of the dorsal side being larger and all alike, not gradually reduced in length, those on the ventral side being much smaller and acutely bent. The two families, Aspersentidae and Heteracanthocephalidae are, however, differentiated from each other through the presence (in the former) or absence (in the latter) of trunk spines in each other.

Aspersentidae was proposed by GOLVAN (1960) to contain three genera, viz, <u>Aspersentis</u> VAN CLEAVE, 1929, <u>Heteracanthocepahalus</u> PETROCHENKO,1956 and <u>Sacahalinorhynchus</u> KROTOV & PETROCHENKO,1956 whereas PETROCHENKO (1956) had, in the meanwhile, placed <u>Aspersentis</u> and <u>Heterosentis</u> under Arhythmacanthidae and <u>Heteracanthocephalus</u> and <u>Sachalinorhynchus</u> under the subfamily Heteracanthocephalinae PETROCHENKO,1956, which he had assigned to Echinorhynchidae. YAMAGUTI (1963) recognised Aspersentidae with <u>Aspersentis</u> only and retained Heteracanthocephalinae under Echinorhynchidae but GOLVAN (1969) later on included these two subfamilies, Aspersentinae GOLVAN,1960 and Heteracanthocephalinae PETROCHENKO,1956 under the family Heteracanthocephalidae. He (GOLVAN,1960) has also considered <u>Heterosentis</u> a junior synonym of <u>Aspersentis</u> and has restricted Aspersentinae to the type genus only. In Heteracanthocephalinae, he has, however, included the two genera _Heteracanthocephalus_ and _Sachalinorhynchus_. The present writer, however, proposes that Aspersentidae and Heteracanthocephalidae be recognised as distinct families, the former containing _Aspersentis_ VAN CLEAVE,1929 and _Heterosentis_ VAN CLEAVE,1931 and the latter family including _Heteracantho-cephalus_ PETROCHENKO,1956 and _Sachalinorhynchus_ KROTOV & PETRO-CHENKO,1956. The synonymy of _Heterosentis_ with _Aspersentis_ is also uncalled for since the two markedly differ from each other in the shape of the body which is elongate cylindrical in the former and short fusiform in the latter (EDMONDS,1964). Further, the lemnisci are shorter than the proboscis receptacle, almost half of its length, in _Aspersentis_ but in _Heterosentis heteracanthus_ (LINSTOW,1896) the lemnisci are markedly longer than the receptacle. The proboscis is short claviform in members of the family Aspersentidae but long, slender and slightly arcuate in Heteracanthocephalidae. Zoogeographically also, these two families are distinguished; _Aspersentis_ and _Heterosentis_ have their distribution restricted to the Southern Hemisphere; species belonging to the former genus characteristically confined to Notothenlid fishes of South Atlantic whereas _H. heteracanthus_ is reported from Atherinid fishes of Terra del Fuego. Species pertaining to the family Heteracanthocephalidae, on the other hand, occur in the Northern Hemisphere and have been reported from the fishes off Siberian Coast of North Pacific.

(12) Family Filisomatidae VAN CLEAVE,1928

The family Filisomatidae (originally named as Filisomidae) was proposed by VAN CLEAVE (1928) with *Filisoma* VAN CLEAVE,1928 as its type and only genus. MEYER (1931,1932) discarded this family and included the genus *Filisoma* within the family Rhadinorhynchidae irrespective of the fact that *Filisoma* does not bear trunk spines. PETROCHENKO (1956) also accepted this emendmend and, instead, aligned *Filisoma* with *Cavisoma*, *Rhadinorhynchoides* and *Pararhadinorhynchus* under the family Cavisomatidae. GOLVAN (1960) recognised the subfamily Filisomatinae GOLVAN,1960 under Gorgorhynchidae and retained three genera, viz. *Filisoma*, *Rhadinorhynchoides* and *Neogorgorhynchus* GOLVAN,1960 within the subfamily (op. cit) but later on (GOLVAN,1969) he relegated *Filisoma* to the family Fessisentidae VAN CLEAVE,1931 which he considered synonymous with Cavisomatidae. YAMAGUTI (1963) has also retained *Filisoma* in Cavisomatinae but has assigned the latter to the family Echinorhynchidae.

All the above mentioned authors have perhaps relied more on the nature of cement glands in *Filisoma* while ascribing it to different supra-generic categories but the characteristics of the genus like the elongate slender proboscis with marked dorso-ventral differentiation of hooks, excessive length of the cement glands and sub-terminal position of the female genital pore have been omitted but these are the characters which distinguish *Filisoma* from all the other known genera of closely related families.

Another closely related genus, *Parafilisoma*, with *Parafilisoma dissungriai*, n. gen et sp. as its type, is described in the present study. This genus is differentiated from *Filisoma* by its marked pseudosegmentation and in having long, convoluted slender lemnisci and the two genera together form a distinct natural group which warrents recognition as an independent family as was originally conceived by VAN CLEAVE (1928) and is upheld in the present study with slight emendment.

Filisomatidae VAN CLEAVE,1928 is,therefore, recognised as a a distinct Palaeacanthocephalan family with two genera,namely, *Filisoma* VAN CLEAVE,1928, the nominal type, and *Parafilisoma*, n.gen. as its constituent members.

(13) Family Cavisomatidae VAN CLEAVE,1931

VAN CLEAVE (1931) proposed the generic name *Cavisoma* for *Oligoterorhynchus magnus* SOUTHWELL,1927 and created the family Cavisomidae to accommodate the genus concerned. MEYER (1932) designated Cavisominae as a subfamily under Echinorhynchidae and assigned *Cavisoma* only to this subfamily. PETROCHENKO (1956) recognised this family and emended its name as Cavisomatidae and included within it the genera : *Cavisoma* VAN CLEAVE,1931, *Rhadinorhynchoides* FUKUI & MORISHITA,1937, *Filisoma* VAN CLEAVE,1928 and *Pararhadinorhynchus* JOHNSTON & EDMONDS,1947.

GOLVAN (1960) first recognised Cavisomatidae and Cavisomatinae both but later, in 1964, he considered the former as an equivalent category of Gorgorhynchidae and synonimised Cavisominae with Fessisentinae (VAN CLEAVE,1931) sic, and included within the latter the seven genera, Fessisentis VAN-CLEAVE,1931, Paracavisoma KRITSCHER,1957, Pseudocavisoma GOLVAN, 1964, Echinorhynchoides ACHMEROV & DOMBROVSKAJA-ACHMEROVA,1941, Rhadinorhynchoides FUKUI & MORISHITA,1937 and Filisoma VAN CLEAVE, 1928; all these genera being characterised by long or short proboscis with a variable numer of longitudinal rows of proboscis hooks, longer or shorter lemnisci, smooth aspinose trunk and four fusiform, claviform, linguiform or tubular cement glands. Subsequently, in 1969, GOLVAN added two more genera, Megapriapus GOLVAN, GRACIA RODRIGO & DIAZ-UN RIA,1964 and Neorhadinorhynchus to this group.and assigned all these genera to the family Fessisentidae instead of Gorgorhynchidae as was previously cited by him (GOLVAN,1960)

YAMAGUTI (1963) partly agreed with Golvan's scheme but included the subfamily Cavisomatinae within the family Echinorhynchidae.

The present writer does not agree with GOLVAN (1960,1964, 1969) and the other authors in considering Cavisomatinae a subordinate category under Fessisentidae or Echinorhynchidae but submits that Cavisomatidae should be recognised independently with the diagnosis subscribed to it by VAN CLEAVE (1931) according to which the following genera could be assigned to it :

(i) Genus Cavisoma VAN CLEAVE, 1931, the nominal type.
(ii) Genus Paracavisoma KRITSCHER, 1957
(iii) Genus Pseudocavisoma GOLVAN, 1964
(iv) Genus Megapriapus GOLVAN, GRACIA RODRIGO & DIAZ-UNGRIA.
(v) Genus Neorhadinorhynchus YAMAGUTI, 1935. n. grad.
(vi) Genus Echinorhynchoides FUKUI & MORISHITA, 1937.

The genus Paracavisoma was proposed by KRITSCHER (1957) for Echinorhynchus impudicus DIESING, 1851, originally reported from Rhinodoras niger of Cuiaba, Matto Grosso, Brazil. This species, which eventually became the type of genus Paracavisoma, is characterised by a short claviform proboscis, shorter lemisci, basal position of cerebral ganglion and four compact attenuated cement glands, with distribution confined to Brazil. This genus is represented in that region through some other closely related species originally assigned to the genus Echinorhynchus.

Through the courtesy of Dr. D.A. Machado Filho, the present writer has been able to re-examine type specimens of some of these species and accordingly submits to transfer the following species to the genus Paracavisoma KRITSCHER, 1957:

(i) *Echinorhynchus gomesi* MACHADO FILHO,1948, (ii) *E. briconi* MACHADO FILHO,1959, (iii) *E. paranensis* MACHADO FILHO,1959, (iv) *E. salobrensis* MACHADO FILHO,1948, (v) *E. jucundus* (TRAVASSOS, 1923. All these species have previously been assigned to the genus *Metechinorhynchus* by GOLVAN (1969) but their names are now emended in context with their new generic assignment, accordingly. These species are listed here as constituent members of the genus *Paracavisoma* KRITSCHER,1957 and are as follows :

(i) *Paracavisoma impudica* (DIESING,1851) KRITSCHE ... -
(ii) *Paracavisoma gomesi* (MACHADO FILHO,1948) n. comb.
(iii *Paracavisoma salobrense* (MACHADO FILHO,1948) n. comb.
(iv) *Paracavisoma briconi* (MACHADO FILHO,1959) n. comb.
(v) *Paracvisoma jucundum* (TRAVASSOS,1923) n. comb.

The genus *Cavisoma* VAN CLEAVE,1931 is monotypic and consists of the type species, *Cavisoma magnum* (SOUTHWELL,1927) only. *Neorhadinorhynchus* YAMAGUTI,1935 is represented byfour species : *N. aspinosus* (FUKUI & MORISHITA,1937), *N. nudus* (HARADA,1938), *N. madagascariensis* GOLVAN,1969and N. robustus (EDMONDS,1964); the remaining genera are monotypic;and are represented by the following species :

(1) *Pseudocavisoma* GOLVAN & HOUIN,1964 by *P. chromitidis* - (CABLE & QUICK,1954) GOLVAN & HOUIN,1964.
(2) *Megapriapus* GOLVAN et al,1964 by *M. ungriai* GOLVAN, et al.
(3) *Echinorhynchoides* A & D-A,1941 by *E. dogieli* A & D-A,1941.
(4) *Rhadinorhynchoides* F & M,1937 by *R. miyagawai* F & M,1937.

(14) Family Fessisentidae VAN CLEAVE,1931 :

Fessisentidae VAN CLEAVE,1931 was originally a monotypic family containing the type genus, *Fessisentis* VAN CLEAVE,1931 only. The most distinguishing features of the family and its nominal type are the excessiveely long testes occupying 2/3 of the total body length in a single linear field, short cylindroid proboscis with relatively a few longitudinal rows of hooks, 4 short linguiform cement glands and the occurrence of two lateral digitiform diverticula on the uterine bell.

Most of the subsequent authors like MEYER (1932), WITENBERG (1932), WARD (1951) and PETROCHENKO (1956) accepted this proposition but GOLVAN & HOUIN (1964) sought for some change and generalised the group by including diverese genera like *Filisoma*, *Paracavisoma*, *Neorhadinorhynchus*, *Rhadinorhynchoides*, *Cavisoma*, and *Pseudocavisoma* within, what they designated as the subfamily Fessisentinae (VAN CLEAVE,1931) which they ascribed to the family Gorgorhynchidae. Later on GOLVAN (1969) changed this subfamilial status and retained Fessisentidae as such, including within it all the genera belonging to Cavisomatidae too.

This decision of GOLVAN (1969) is,however, arbitrary since he has perhaps failed to evaluate the most distinguishing and consistent feature of this family, and the genus too, i.e. the typical anatomy of the testes and the uterine bell. YAMAGUTI (1963) and more recently, NICKOL (1972) have emphasised these two characters in the recognition of the family Fessisentidae and the present author entirely agrees with them in retaining Fessisentidae as a monotypic entity within the Palaeacanthocephala and, further, propose that the remaining genera assigned to this family be relegated to the family Cavisomatidae.

(15) Family Hypoechinorhynchidae GOLVAN,1960 :

YAMAGUTI (1939) described the genus *Hypoechinorhynchus*, with *H. alaeopis* from Japan as its type species and SZIDAT (1950) added another closely resembling species, *H. magellanicus* from Argentina. These species and the genus *Hypoechinorhynchus*, which very closely resemble *Neoechinorhynchus* in their proboscis anatomy, were initially assigned to Echinorhynchidae but PETROCHENKO (1956) first created the subfamily Hypoechinorhynchinae to contain the genera *Hypoechinorhynchus*, *Bolborhynchoides*, *Acanthocephaloides* and *Paracanthocephalus*, and ascribed the subfamily to Echinorhynchidae. GOLVAN (1960) raised it as Hypoechinorhynchidae and retained the genus *Hypoechinorhynchus* only but later, in 1969, he added *Bolborhynchoides* to this family. YAMAGUTI (1963) also maintained these two genera, *Hypoechinorhynchus* and *Bolborhynchoides* within the subfamily Hypoechinorhynchinae and preferred to retain it under Echinorhynchidae.

The present author agrees with GOLVAN (1960) in retaining *Hypoechinorhynchus* as the only genus within Hypoechinorhynchidae which can readily be distinguished from Echinorhynchidae as well as other Palaeacanthocephalan families essentially on the basis of praesomal organization.

The genus Bolborhynchoides ACHMEROV,1959 is sustained through its type species, Bolborhynchoides exiguus (ACHMEROV & DOMBROVSKAJA-ACHMEROVA,1941) which is characterised by oblong proboscis armed with 5 oblique rows of 5 hooks each, basal 2 of each row being much smaller than the anterior 3, and a 'rectangular' neck - a character too enigmatic to be believed since rectangular configuration is not met with in any organ or organism anywhere in the animal kingdom ! The description of B. exiguus is also inadequate and inconclusive since the species has been described from four immature specimens only; all of them females. It may be surmised that B. exiguus is related to Acanthocephaloides and, therefore, it will not be improper if it is relegated to Echinorhynchidae, along with the genus Paracanthocephalus A & D-A, 1941 which too has been included within Hypoechinorhynchinae.

(16) Family Mirzasentidae , new family :

With the characters of the genus Mirzasentis and its type, Mirzasentis tereuis gen. et sp. nov.

The most distinguished character of this family and its constituent taxa is the typical form of the lemniscular ring at the base of the neck, around the distal region of the proboscis receptacle. The family has closer affinities with Echinorhynchidae and Cavisomatidae but can be differentiated from both through the structural peculiarity of the circular lemniscular ring and the number and nature of cement glands.

The family is, at present, represented by the genus _Mirzasentis_ only.

(17) _Family Echinorhynchidae COBBOLD,1879_ :

Echinorhynchidae happens to be the first family instituted among the Acanthocephala and has since then been an index of the evolution of acanthocephalan taxonomy for its has often given rise to the formation of the concepts of higher taxonomic categories in the group. The superfamily Echinorhynchoidea was first proposed by RAUTHER in 1930 and was designed once more by GOLVAN & HOUIN in 1963. The suborder Echinorhynchidea of SOUTHWELL & MACFIE (1925), the order Echinorhidea of THAPAR (1927), WITENBERG (1932), Echinorhynchata of FAUST (1928), Echinorhynchida of PETROCHENKO (1956) and the subclass Echinorhynchinea of PETROCHENKO (1956) are all essentially augmented concepts of the family Echinorhynchidae.

Originally the family contained 'the all-inclusive genus' _Echinorhynchus_ MULLER,1776 and was first reviewed by TRAVASSOS in 1926, who first divided it into two subfamilies, (a) Echinorhynchinae TRAVASSOS,1926, containing the genera _Echinorhynchus_, _Acanthocephalus_ KOELREUTHER,1771 and _Pomphorhynchus_ MONTICELLI,1905, and (b) Centrorhynchinae TRAVASSOS,1926, comprising ten varied genera chiefly occurring in birds. WITENBERG (1932) classified it into three subfamilies, viz, Echinorhynchinae TRAVSSOS,1926, Corynosominae WITENBERG,1932 and Leptorhynchoidinae WITENBERG, 1932 but the characterization of these subfamilies was rather generalised since Echinorhynchinae contained the genera Moniliformis TRAVASSOS,1915, Fessisentis VAN CLEAVE,1931 and Filisoma VAN CLEAVE,1928 besides the typically Echinorhynchid genera, Echinorhynchus and Acanthocephalus.

MEYER (1932) counted upon the shpae and armature of the proboscis and the nature of cement glands (four short tubular or six pyriform follicular) as essential criteria for the characterisation of the subcategories of Echinorhynchidae and accordingly divided this family into three subfamilies, viz, (a) Echinorhynchinae MEYER,1931 (sic), comprising Echinorhynchus, Acanthocephalus and Acanthocephaloides MEYER,1932, (b) Cavisominae MEYER,1932 (sic), containing Cavisoma VAN CLEAVE,1931 and (c) Pomphorhynchinae MEYER, 1931, to include Pomphorhynchus MONTICELLI,1905 only.

PETROCHENKO (1956) ascribed Echinorhynchidae to the order Echinorhynchida and classified the former into (a) Echinorhynchinae, (b) Hypoechinorhynchinae, (c) Heteracanthocephalinae and (d) Hypoechinae; the latter three subfamilies having been proposed as new by him. Echinorhynchinae was the nominal type and these four subfamilies were differentiated and distinguished from each other essentially on the basis of proboscis organization and secondly the number of cement glands in the males. In Echinorhynchinae and Leptorhynchoidinae the proboscis is elongate, cylindrical, with longitudinal rows of hooks without dorso-ventral differentiation and the number of cement glands as six in the former and consistently eight in the latter; in Heteracanthocephalinae the proboscis exhibits marked differentiation in size of hooks on the dorsal and ventral sides, cement glands being six wehereas in Hypoechinorhynchinae the proboscis is short spheroidal and beset with hooks of three distinct types. These characters on the basis of which these three subfamilies are differentiated from Echinorhynchinae are of considerable significance and have been regarded of familial value by subsequent authors. Hence these three subfamilies have been upgraded as independent groups and have been considered as families by GOLVAN (1960, 1964, 1969) and some by YAMAGUTI (1963) as well. A detailed discussion in this regard has already been furnished in the present study (pp. 238, 246).

YAMAGUTI (1963) has also maintained the same four submalies in Echinorhynchidae which PETROCHENKO (1956) has assigned to it and has added Cavisomatinae also with these four. Under Echinorhynchinae, PETROCHENKO (1956) has included the genera Echinorhynchus, Acanthocephalus, Echinorhynchoides and two 'new' genera, namely, Pseudoechinorhynchus PETROCHENKO, 1956 and Metechinorhynchus PETROCHENKO, 1956. These last two genera have been sifted out from the pre-existing genus Echinorhynchus from which they have been differentiated on the basis of the dimentional arrangement of cement glands. Echinorhynchus has been typified by E. gadi MÜLLER, Pseudoechinorhynchus by P. clavula (DUJARDIN,1845) and Metechinorhynchus by M. salmonis (MULLER,1780). The genera Acanthocephaloides MEYER,1932 and Paracanthocephalus A & D-A,1941, which also conform with the concept of Echinorhynchinae, and are more closely related with Acanthocephalus have, however, been placed under Hypoechinorhynchinae presumably on the basis of the smaller size of the proboscis and lesser number of hooks but this deviation is not so wide as to warrent the inclusion of these two genera under a different subfamily. The genus Pseudoacanthocephalus PETROCHENKO,1956, which agrees with Acanthocephalus in all essential morphological and synecological features has paradoxically been assigned to a different order, and a different subclass even, the Gigantorhynchida of Gigantorhynchinea, respectively. The reason for this assignment and relegation as given by PETROCHENKO (1956) is the nature of the spination of the embryo, essentially, and the nature of the middle egg-shell, secondarily. The emryo of Pseudoacanthocephalus bufonis has been described to be holoechine type and the middle shell without polar modifications - two characters which PETROCHENKO (1956) asserted to be of much higher a taxonomic significance but these have been refuted by GRABDA KAZUBSKA (1964) who has shown through extensive investigations that the pattern of cuticular spines over the embryo varies within the same genus and thus can not be relied upon as a consistent higher taxonomic value. The presence or absence of polar bulbs on the middle egg-shell too is not a consistent feature; in some species this modification is wanting whereas in some species, e.g. in *Pseudoacanthocephalus caucasicus* PETROCHENKO 1958 and in certain geographical races of *Pseudoacanthocephalus bufonis* (SHIPLEY,1903) the polar bulbs are known to be present. In *P. bufonis* this character appears as an intra-specific variation; PETROCHENKO (1958) has shown the eggs of these parasites without such bulbs but JOYEUX & BAER (1935) and YUEN & FERNANDO (1967) have indicated these bulbs on the inner middle-shell of the eggs of what they have determined as *Acanthocephalus bufonis* SHIPLEY,1903. This has,therefore, led GRABDA KAZUBSKA (1964) to consider *Pseudoacanthocephalus* PETROCHENKO,1956 an obvious synonym of *Acanthocephalus* KOELREUTHER,1771.

YAMAGUTI (1963) has considered *Pseudoacanthocephalus* PETROCHENKO,1956 and *Metechinorhynchus* PETROCHENKO,1956 as congeners of *Echinorhynchus* MULLER,1776 and has retained within Echinorhynchinae the genera *Acanthocephalus*, *Acanthocephaloides*, *Metacanthocephalus* YAMGUTI,1959 and *Metacanthocephaloides* YAMAGUTI, 1959 alongwith the nominal type - the genus *Echinorhynchus*. He has, however, accepted the family Pseudoacanthocephalidae under Gigantorhynchidea and has considered *Pseudoacanthocephalus* a valid genus.

GOLVAN (1960) initially considered the three genus groups, *Echinorhynchus*, *Pseudoechinorhynchus* and *Metechinorhynchus* as subgenera of the genus *Echinorhynchus* (s.s) and maintained it within Echinorhynchinae along with *Acanthocephalus* and *Acanthocephaloides*. In addition to Echinorhynchinae, GOLVAN (1960) has included the subfamily [illegible], which he has proposed as a new subcategory under the family Echinorhynchidae. But in a recent review GOLVAN (1969) has altered the complexion of Echinorhynchidae by deleting Neoacanthocephaloidinae and replacing it with another new subfamily, Yamagutisentinae GOLVAN, 1969 with Yamagutisentis GOLVAN, 1969 as its nominate genus, characterised by fusiform trunk with minute spines on the anterior trunk region, claviform proboscis and six pyriform cement glands. In the second subfamily, i.e. Echinorhynchinae he has retained the genera Echinorhynchus, Pseudoechinorhynchus, Metechinorhynchus, Metacanthocephaloides, Acanthocephalus and Pseudoacanthocephalus but has relegated Acanthocephaloides (=Paracanthocephaloides GOLVAN, 1969) to Arhythmacanthidae, Acanthocephaloides :GOLVAN, 1969 nec MEYER, 1932 to Neoacanthocephaloidinae and Metacanthocephalus to Leptorhynchoididae. Another two closely related genera, viz. Euzetacanthus GOLVAN & HOUIN, 1964 (originally assigned to Echinorhynchidae) and Breziacanthus GOLVAN, 1969 , both consonant with Echinorhynchinae, have also been included within Paracanthocephaloidinae of the family Arhythmacanthidae.

The present author does not submit entirely to the views and prepositions of YAMAGUTI (1963) as well as GOLVAN (1960 and 1969) regarding the classification of Echinorhynchidae. In the first instance, Echinorhynchidae is specified as a group of essentially aspinose genera with elongated or claviform to cylindrical proboscis, without any dorso-ventral differentiation of hooks, and with (consistently) six cement glands with certain somatic modifications within synchronous range but not exceeding generic

value. Consequently Cavisomatinae, Heteracanthocephalinae, Hypoechinorhynchinae and Leptorhynchoidinae are relegated from Echinorhynchidae and are recognised as distinct families.
The genus Pseudoacanthocephalus PETROCHENKO,1956 has already been reduced as a junior synonym of Acanthocephalus, hence the family Pseudoacanthocephalidae PETROCHENKO,1956 is also deleted as a synonym of Echinorhynchidae. The genus Paracanthocephalus ACHMEROV & DOMBROVSKAJA-ACHMEROVA,1941 has, on the other hand been recognised as a congener of Acanthocephalus by YAMAGUTI (1963) and also by GOLVAN (1969) but the validity of this genus has recently been asserted by GRABDA & GRABDA-KAZUBSKA (1967) who have distinguished the former genus (Paracanthocephalus) by the presence of a distinct 'pseudocollum' as a muscularised transitional region between the proboscis and the trunk. YAMAGUTI (1963) and GOLVAN (1969) perhaps failed to appreciate the morphological significance of this pseudocollum and hastened to the synonymy of Paracanthocephalus with Acanthocephalus. GRABDA & GRABDA-KAZUBSKA (1967) have consistently observed this structure not only in Paracanthocephalus tenuirostris A & D-A,1941 but also in the numerous specimens of Acanthocephaloides gracilacanthus MEYER,1932, which, by virtue of the presence of pseudocollum, GRABDA & GRABDA-KAZUBSKA (1967) have renamed as Paracanthocephalus gracilacanthus (MEYER, 1932).

The splitting of the genus Echinorhynchus into the genera Echinorhynchus (s.s) PETROCHENKO,1956, Pseudoechinorhynchus PETROCHENKO,1956 and Metechinorhynchus PETROCHENKO,1956 as effected by PETROCHENKO (1956) and accepted by YAMAGUTI (1963) and lately by GOLVAN (1969) also seems unwarrented mainly for the reason that these genera are specifically created on the basis of a character which is menifested in one sex only secondly there is still a good number of species in the genus *Echinorhynchus* which have been described through female specimens only and therefore can not be precisely placed under any of the three unless the number and dimentional arrangement of cement glands is known. Further, the genus *Pseudoechinorhynchus* PETROCHENKO,1956 is untenable since the name is preoccupied with *Pseudoechinorhynchus* GOEZE,1782 and has been in use till 1922 ; secondly its type species, *Pseudoechinorhynchus clavula* (DUJARDIN,1845) (= *Echinorhynchus clavula* DUJARDIN,1845) is no more available under *Pseudoechinorhynchus* or *Echinorhynchus* since it has been determined as and transferred to the genus *Acanthocephalus* by GRABDA-KAZUBSA & CHUBB (1968) who have renamed it as *Acanthocephalus clavula* (DUJARDIN,1845) GRABDA-KAZUBSKA & CHUBB,1968.

It would,therefore, be more appropriate that these three thus formed genera be recognised as subgenera of the genus *Echinorhynchus* as was previously proposed by GOLVAN (1960) and the name *Pseudoechinorhynchus* PETROCHENKO,1956, nec. GOEZE,1782 is replaced with *Parechinorhynchus* nom. nov. with *Echinorhynchus (Parechinorhynchus) borealis* LINSTOW,1901 as type of the subgenus.

The family Echinorhynchidae is proposed to be divided into two subfamilies, viz., (a) Echinorhynchinae TRAVASSOS,1920, comprising the genera *Echinorhynchus* MULLER,1776, the nominal genus, Acanthocephalus KOELREUTHER,1771, Paracanthocephalus ACHMEROV & DOMBROVSKAJA-ACHMEROVA,1941, Metacanthocephaloides YAMAGUTI,1959 and Euzetacanthus GOLVAN & HOUIN,1964, and, (b) Paracanthocephaloidinae GOLVAN,1969, to include Acanthocephaloides MEYER,1932, nec GOLVAN,1969, the type genus, and, Breziacanthus GOLVAN,1969. The subfamily Paracanthocephaloidinae is,however, conserved in accordance with Article 40 since its erstwhile type genus Paracanthocephaloides GOLVAN,1969 is considered a synonym of Acanthocephaloides MEYER,1932. The subfamily Paracanthocephaloidinae and its constituent genera are thus characterised by the typical organization of the proboscis on which the posterior hooks of each longitudinal row are relatively much smaller than the anterior few hooks many times longer than the posteriors.

(18) Family Leptorhynchoididae WITENBERG,1932 :

The present writer endorses the decision of GOLVAN (1969) for recognising Leptorhynchoididae as a distinct family although originally it was designated as a subfamily under Echinorhynchidae. The family is typified by the genus Leptorhynchoides KOSTYLEW,1924 which is characterised by an elongated slender proboscis with numerous longitudinal rows of hooks projecting only a little from the cuticular sheath, long tubular lemnisci, and, eight short follicular cement glands.

Initially Leptorhynchoidinae contained the type genus only but recently GOLVAN (1969) has added to it the genus Metacanthocephalus YAMAGUTI,1959 also since its type species, M. pleuronichthydis YAMAGUTI,1959 also possesses eight cement glands and the cerebral ganglion is situated anteriorly in the proboscis sac.

(19) Family Pomphorhynchidae YAMAGUTI,1939 :

This family is an upgradation of Pomphorhynchinae MEYER,1931 which was originally assigned to Echinorhynchidae and had included only the type genus - *Pomphorhynchus* MONTICELLI,1905. Later on YAMAGUTI (1939) recognised it as a distinct family and, besides the nominal type, *Pomphorhynchus*, added two more closely related genera, viz., *Longicollum* YAMAGUTI, 1939 and *Tenuiproboscis* YAMGUTI,1939. Since then the family has attained stability and has not been subjected to any emendment. Nevertheless, a good number of species has, in recent years, been described under the different genera of this family.

Pomphorhynchus is relatively a larger genus group and its species have a broader host-spectrum and wider distribution. *Pomphorhynchus laevis* (MULLER,1776) - the type species, *P. bolbocolli* VAN CLEAVE, 1919, *P. sebastichthydis* YAMAGUTI,1939 , *P. rocci* CORDONNIER & WARD,1967 and *P. francoisae* GOLVAN,1959 are recorded from marine fishes; *P. kostylewi* PETROCHENKO,1956, *P. perforator* (LINSTOW,1908), *P. intermedius* ENGLEBRECHT,1957 and *P. kashmiriensis* KAW,1941 from fresh-water fishes of the Palaearctic and Oriental region and *P. dubius* KAW,1941 and *P. bufonis* FOTEDAR, DUDA & RAINA,1970 from the frogs and toads of Kashmir. *Pomphorhynchus dubius* KAW,1941 is perhaps an underdeveloped form of *P. kashmiriensis* KAW,1941 since both are identical except the former was found in the peritonial cavity of the frog only once and has not been recorded since then. The organization of the two Indian species, P. dubius KAW,1941 and P. kashmiriensis KAW,1941 is almost identical except some minor intra-specific variations like the difference of one or two spines in each row or oval or spherical shape of the testes. Consequently P. dubius KAW,1941 is considered a synonym of P. kashmiriensis KAW,1941. Pomphorhynchus indicus GUPTA & LATA,1967 is apparently a generic mis-identification, instead it is an attenuated form of a Centrorhynchus species which GUPTA & LATA (1967) have recorded from an eagle, Astur badius, at Chandigarh. GOLVAN (1969) has renamed it is Centrorhynchus guptai but the description of this species is too meagre and inconclusive to accord it any positive identity. Till such time a detailed description of this species is refurnished, it should better be considered an indeterminate taxon. Pomphorhynchus indicus GUPTA & LATA,1967 is,however, a nomen nudum.

Pomphorhynchus tereticollis (RUDOLPHI,1809) also has a doubtful identity. MEYER (1932) has considered it a form of P. laevis (MULLER,1776) and could not finally establish it as a distinct species. ENGLEBRECHT (1957) has also questioned its validity. Pomphorhynchus tereticollis (RUDOLPHI,1809) et auctt., is possibly a composite species group; P. tereticollis (RUDOLPHI) of BELLINGHAM (1844) is conspecific with P. laevis, whereas, P. tereticollis of LINTON,1888 is a synonym of P. bulbocolli VAN CLEAVE,1919.

The genus *Longicollum* YAMAGUTI,1935 is differentiated from the other two genera in the family Pomphorhynchidae by the typically long neck, often spirally twisted, short claviform proboscis, absence of bulla and modification of the lemnisci. Originally it was a monotypic genus but a good number of species has been described in this genus in recent years. These species are categorised into two distinct groups : (a) the lemnisculate species, and, (b) the alemnisculate species. The former group comprises : (i) *Longicollum edmondsi* (JOHNSTON & EDMONDS,1951) GOLVAN,1969, (ii) *L. sergenti* (CHOQUETTE & GAYOT,1952) GOLVAN,1969 and *L. pulcher*, n. sp., whereas the latter group includes (i) *L. pagrosomi* YAMAGUTI,1935, the type of the genus, (ii) *L. alemniscus* HARADA,1935, (iii) *L. chabanaudi* DOLLFUS & GOLVAN,1963, (iv) *L. noellae* GOLVAN,1969 and *L. riouxi* GOLVAN,1969.

Tenuiproboscis YAMAGUTI,1935 is characterised by a long slender proboscis borne over a comparatively broader and longer neck. It had previously comprised two species, *T. misgurni* YAMAGUTI, the type species, and *T. sergenti* CHOQUETTE & GAYOT,1952 but the latter has appropriately been transferred to the genus *Longicollum* by GOLVAN (1969) since the proboscis of the former (*T. sergenti*) is short claviform and not slender filiform as is characteristic in the genus *Tenuiproboscis*. Hence this genus is now restricted to its type species only.

(20) Family Polymorphidae MEYER,1931 :

Polymorphidae is a typical Palaeacanthocephalan family whose constituent genera are parasitic in carinate birds. The family is characterised by forms with fusiform or cylindrical trunk armed with distinct cuticular spines on the fore-trunk region, oval or cylindrical proboscis with quincunxial pattern of hooks, fusiform lemnisci and 4 - 6 pyriform or tubular cement glands.

Originally the family had a varied characterization since it contained spinose as well as aspinose genera, some of them so different from each other that they were not tenable under one compact family. Initially this family was divided into three subfamilies, (a) Polymorphinae MEYER,1931, (b) Centrorhynchinae MEYER,1931 and (c) Plagiorhynchinae MEYER,1931 ; only the first of these comprised spinose genera whereas the latter two families included aspinose forms. These three subfamilies were, however, distinguished and differentiated from each other essentially on the basis of trunk spination and secondarily on the basis of the insertion of the proboscis receptacle but these characters are manifested so consistently in the various genera that it seems best considering them of familial value since it would provide a rationale for the grouping of various genera on morphological as well as phylogenetic basis. Among these three subfamilies, Plagiorhynchinae contains more primitive genera like Plagiorhynchus LÜHE,1911 which has closer affinities with Echinorhynchus, or.

Sphaerechinorhynchus JOHNSTON, 1929, whose species occur in Ophidians exclusively. Corynosoma LUHE, 1905 and Bolbosoma PORTA, 1908 are morphologically so distinct that each represents a separate supra-generic category and as such both are untenable within Polymorphidae. Centrorhynchus LUHE, 1911 is a genus of higher evolved species which have undergone remarkable speciation among the various avian groups and their host-spectrum warrents recognition of their Centrorhynchid parasite-fauna as a distinct group. These three subfamilies thus do not form a coherent group and each thus merits recognition as an independent family group.

PETROCHENKO (1956) diversified the taxonomy of these 'Polymorphid' groups by placing Polymorphidae MEYER, 1931, emend. PETROCHENKO, 1956, comprising the subfamilies Polymorphinae, Plagiorhynchinae and Corynosominae PETROCHENKO, 1956 (sic), under the order Polymorphida PETROCHENKO, 1956 and Centrorhynchinae under Gigantorhynchida which also included two more such closely related families, viz, Filicollidae PETROCHENKO, 1956 and Prosthorhynchidae PETROCHENKO, 1956. YAMAGUTI (1963) has adopted a similar heterogeneous arrangement since he placed Ploymorphidae, Filicollidae and Plagirohynchidae under the order Echinorhynchidea and classified Centrorhynchidae and Prosthorhynchidae under Gigantorhynchidea. GOLVAN (1960) has, on the other hand, retianed these families within the order Palaeacanthocephala and has brought in much more homogeneity in classfying these genera under various families. However, *certain emendments are still necessary and warrant a* reorganization of all these genera previously placed in Polymorphidae.

MEYER (1931) has essentially distinguished Polymorphinae from other subfamilies of Polymorphidae by the presence of trunk spines in the constituent genera of the former and accordingly he assigned Polymorphus LUHE, 1911, Profilicollis MEYER, 1931, Filicollis LUHE, 1911, Corynosoma LUHE, 1905, Bolbosoma PORTA, 1908 and Arhythmorhynchus LUHE, 1911 to Polymorphinae MEYER, 1931. But this was not an entirely a new arrangement effected by MEYER (1931) but these genera (except Profilicollis) were already grouped under the family Corynosomidae by SOUTHWELL & MACFIE (1925) who had proposed that family anew but it was perhaps overlooked by MEYER (1931, 1932). PETROCHENKO (1956) proposed Corynosominae as a new subfamily for the genera Corynosoma and Bolbosoma, and, created the family Filicollidae for Filicollis and Parafilicollis PETROCHENKO, 1956. Within the subfamily Polymorphinae, he has included the genera Polymorphus, Arhythmorhynchus, Hexaglandula and Skrjabinorhynchus ; the latter two having been proposed as new genera by PETROCHENKO (1956). In the meantime, two more genera, Diplospinifer and Southwellina, conforming with the concept of Polymorphinae, were prposed by FUKUI (1929) and by WITENBERG (1932), respectively, but the former genus was considered synonym of Bolbosoma by MEYER (1932) and the latter of Arhythmorhynchus by CHANDLER (1935).

GOLVAN (1960) has classified Polymorphidae into Corynosominae and Polymorphinae and has included within the latter, the genera, Polymorphus, Arhythmorhynchus, Filicollis, Parafilicollis, Hexaglandula and Skrjabinorhynchus whereas YAMAGUTI (1963) restricted

Polymorphinae to Polymorphus, Arhythmorhynchus, Hexaglandula and Skrjabinorhynchus, and relegated Parafilicollis and Filicollis to Filicollidae.

PETROCHENKO & SMOGORZHEVSKAYA (1952) added one more genus, Hemiechinosoma, with H. ponticum PETROCHENKO & SMOGORZHEVSKAYA, 1952 as its type, to the family Polymorphidae. This genus is regarded as a link between Polymorphus and Corynosoma from which it differs in having two girdles of spines on the fore-trunk and lack of genital spines. Polymorphus ardeae BELOPOLSKAYA,1958 and Corynosoma mergi LUNDSTROM,1942 have also been transferred to Hemiechinosoma by PETROCHENKO & SMOGORZHEVSKAYA (1962) and these two species have been renamed as H. ardeae (BELOPOLSKAYA,1958) and H. mergi (LUNDSTROM,1942) by these authors, respectively. However, in having two successive bands of cuticular spines on the fore-trunk, Hemiechinosoma agrees with definition of Diplospinifer FUKUI,1929 and also agrees with Southwellina WITENBERG,1932 and is obviously a synonym of these two. Southwellina WITENBERG,1932, however, is not an available and valid name since it contravenes Article 16 and is, therefore, cosidered nomen nudum. Diplospinifer FUKUI,1929 is conserved and besides Diplospinifer serpenticola FUKUI,1929, all those polymorphid species which are characterised by two girdles of trunk spines, are assigned to it. Thus it comprises Diplospinifer serpenticola FUKUI,1929, the type species, D. ardeae (BELOPOLSKAYA,1958) n. comb., D. ponticum (PETROCHENKO & SMOGORZHEVSKAYA,1962), D. duocinctus (CHANDLER,1935) and D. hispidus (VAN CLEAVE,1925) comb. nova.

Polymorphinae to *Polymorphus*, *Arhythmorhynchus*, *Hexaglandula* and *Skrjabinorhynchus* but relegated *Filicollis* and *Parafilicollis* to Filicollidae.

PETROCHENKO & SMOGORZHEVSKAYA (1962) added another genus, *Hemiechinosoma*, with *H. ponticum* PETROCHENKO & SMOGORZHEVSKAYA, 1962 as its type species, to the family Polymorphidae. This genus has been regraded as a link between *Polymorphus* and *Corynosoma* from which it is differentiated by having two girdles of cuticular spines, separated by a short smooth gap, on the fore trunk and by the absence of cuticular spines at the genital pore - the characteristic feature of *Corynosoma*. *Polymorphus ardeae* BELOPOLSKAYA, 1958 and *Corynosoma mergi* LUNDSTROM, 1942 have also been transferred to *Hemiechinosoma* by PETROCHENKO & SMOGORZHEVSKA (1962) and these two species have been renamed as *H. ardeae* (BELOPOLSKAYA, 1958) and *H. mergi* (LUNDSTROM, 1942), respectively.

In having two successive girdles of cuticular spines on the fore trunk and short ellipsoidal proboscis, slightly wider in the middle, with quincunxially arranged hooks, *Hemiechinosoma* falls within the definition of *Diplospinifer* FUKUI, 1929 as well as *Southwellina* WITENBERG, 1932 which have been attributed the same generic characters as of *Hemiechinosoma*. Consequently *Hemiechinosoma* falls as a synonym of these two genera. *Southwellina* WITENBERG, 1932 is, however, untenable since its indication contravens Article 16 and is, therefore, considered a nomen nudum.
Diplospinifer FUKUI, 1929 is conserved and besides its type species,

Diplospinifer serpenticola FUKUI,1929, four more species, viz., *Diplospinifer hispidus* (VAN CLEAVE,1925) n. comb., *D. duocinctus* (CHANDLER,1935) n. comb., *D. ardeae* (BELOPOLSKAYA,1958) n. comb., and *D. ponticae* (PETROCHENKO & SMOGORZHEVSKAYA,1962) n. comb.

D. hispidus (VAN CLEAVE,1925) and *D. duocinctus* (CHANDLER, 1935) were originally assigned to the genus *Arhythmorhynchus* LUHE, 1911 but on the basis of their structural features these two species are not compatible with the concept of *Arhythmorhynchus* which is henceforth characterised by elongated cylindrical trunk with cuticular spines laid in a singel anterior field, long neck and proboscis distincly broader in the middle with markedly larger ventral hooks. The cement glands are fairly long and tubular and occupy about 2/3 the length of the trunk in *Arhythmorhynchus* whereas in *Diplospinifer* these glands are short and cylindrical and the trunk is typically short, fusiform. The genus *Skrjabinorhynchus* PETROCHENKO,1956 has also been distinguished from *Arhythmorhynchus* on similar grounds but only *Skrjabinorhynchus capellae* (YAMAGUTI,1935) PETROCHENKO,1956 conforms with this emended generic concept whereas *Skrjabinorhynchus eroliae* (YAMAGUTI,1939) PETROCHENKO,1958 conforms with the definition of *Arhythmorhynchus* in every respect except the presence of polar bulbs on the middle shell in the former, but this is a variable character in the genus *Arhythmorhynchus* and can not therefore be regarded as a justification for the transfer of *Arhythmorhynchus* eroliae YAMAGUTI,1939 to *Skrjabinorhynchus* PETROCHENKO,1956 which is henceforth restric- to its type species only.

The genus Hexaglandula was proposed by PETROCHENKO (1950) for those species of Polymorphus which possess six cement glands. Subsequently he included Hexaglandula mutabilis (RUDOLPHI, 1819) PETROCHENKO, 1950, H. corynosoma (TRAVASSOS, 1915) PETROCHENKO, 1958, H. inermis (TRAVSSOS, 1923) PETROCHENKO, 1958 and H. paucihamata (HEINZE, 1936) PETROCHENKO, 1958 within this group but the exact number of (six) cement glands is known in the fist two of these species only and not in the case of the latter two which fully conform with the general plan of Polymorphus and, consequently, their assignment to the genus Hexaglandula is not justified. Hence these two species, H. corynosoma and H. paucihamata are referred back to their original generic assignment and Hexaglandula limited to H. mutabilis, the type, and H. corynosoma.

The genus Polymorphus is retained with the concept instituted for it by LUHE (1911), and as restricted by the removal of the concepts of Skrjabinorhynchus and Hexaglandula and partly of Diplospinifer which is a link between Polymorphus and Arhythmorhynchus also. Polymorphus was first splitted by MEYER (1931, e) into two genera, (a) Polymorphus LUHE, 1911, s.s., and (b) Profilicollis MEYER, 1931, *which was differentiated from the former by* having a relatively longer neck, short spheroidal proboscis and oval middle shell devoid of polar bulbs. Profilicollis botulus VAN CLEAVE, 1916) MEYER, 1931 was designated as its type species and P. arcticus (VAN CLEAVE, 1920) MEYER, 1931 as its second member. WEBSTER (1948) considered Profilicollis congeneri with Polymorphus and splitted the latter into two subgenera, (a) Polymorphus

WEBSTER,1948 and (b) Falsifilicollis WEBSTER,1948. The former subgenus comprised species of Polymorphus s.s. with short neck and oval or ellipsoidal proboscis and the latter subgenus embraced those species which possess, in either sex or in both, spheroidal and slightly inflated proboscis and slender elongate neck. This subgenus thus included four species, namely, P. (Falsifilicollis) - altmani (PERRY,1942), the type species, P. (F) sphaerocephalus (BREMSER,1819) VAN CLEAVE, 1947, P.(F) kenti VAN CLEAVE,1947 and P. (F) texensis WEBSTER,1948. PETROCHENKO (1956) discarded Webster's proposal and, instead, created the genus Parafilicollis, with Parafilicollis altmani (PERRY,1942) as its type, to include those species which were previously accommodated by WEBSTER (1948)under the subgenus Falsifilicollis. YAMAGUTI (1963) considered the species included by WEBSTER (1948) under the/genus Falsifilicollis a distinct group, as already envisaged by PETROCHENKO (1956),and accordingly upgraded Falsifilicollis to a full generic status and renamed the constituent species as Falsifilicollis altmani (PERRY,1942) WEBSTER,1948, F. kenti (VAN CLEAVE,1947) YAMGUTI,1963, F. major (LUNDSTROM,1942) YAMAGUTI,1963, F. texensis WEBSTER,1948 and F. spherocephalus (BREMSER,1821) YAMAGUTI,1963, but he assigned all these species and the genus Falsifilicollis to the family Filicollidae PETHOCHENKO,1956.

SCHMIDT & KUNTZ (1967) disagreed with YAMAGUTI's propsal of the genus Falsifilicollis since they transferred all the species assigned to the latter by YAMAGUTI (1963) to the genus Polymorphus. These authors divided the genus Polymorphus into two subgenera :

(a) subgenus _Polymorphus_ WEBSTER,1948 with _P_. _minutus_ as the type species, and, (b) subgenus _Profilicollis_ (MEYER,1931) GOLVAN,1960 with _P_. (_Profilicollis_) _botulus_ (VAN CLEAVE,1916) VAN CLEAVE,1947 as its type. SCHMIDT & KUNTZ (1967) thus considered _Parafilicollis_ PETROCHENKO,1956, _Falsifilicollis_ YAMGUTI,1963 and the subgenus _Falsifilicollis_ WEBSTER,1948 as a synonym of the subgenus _Profilicollis_ (MEYER,1931) since they transferred the species formerly assigned by WEBSTER (1948) and YAMAGUTI (1963) to the subgenus and later genus _Falsifilicollis_, and to the genus _Parafilicollis_ by PETROCHENKO,(1958) to the subgenus _Profilicollis_ of the genus _Polymorphus_, and this arrangement quite appropriate indeed.

KHOKHLOVA (1967) has also attempted to classify Polymorphinae and has divided the genus _Polymorphus_ LUHE,1911 into three new subgenera : (a) _Polymorphus_ : KHOKHLOVA,1967, with _P_. _minutus_ as its type, (b) _Subfilicollis_ KHOKHLOVA,1967 and (c) _Subcorynosoma_ KHOKHLOVA,1967, with _P_. _strumosoides_ LUNDSTROM,1942 as its type. This classification is, however, untenable since the designation of the three co-ordinate taxa, _Polymorphus_ : KHOKHLOVA,1967, _Subfilicollis_ and _Subcorynosoma_ is contrary to Article 43 and is, therefore, discarded.

The family Polymorphidae MEYER,1931 thus comprises the five genera : _Polymorphus_ LUHE,1911, _Arhythmorhynchus_ LUHE,1911, _Skrjabinorhynchus_ PETROCHENKO,1956, _Hexaglandula_ PETROCHENKO,1956 and _Diplospinifer_ FUKUI,1929. The subfamily Polymorphinae becomes redundant and is therefore deleted.

(21) <u>Family Filicollidae PETROCHENKO,1956</u> :

This family was proposed by PETROCHENKO (1956) to contain the genera *Filicollis* LUHE,1911, the nominal type, and *Parafilicollis* PETROCHENKO,1956. The latter genus,however, agrees with the emended diagnosis of the subgenus *Profilicollis* (MEYER,1931) SCHMIDT & KUNTZ,1967 and its constituent species have already been transferred to the genus *Polymorphus*. Filicollidae is thus left with the single genus *Filicollis* and is essentially distinguished by the characters of its nominal type, viz., marked sexual dimorphism menifested through the excessive spherical distention of the proboscis with hooks displayed radially, distinct long slenedr neck, thick cuticle with spines on the fore-trunk and with four or six short reniform of tubular cement glands. MEYER (1931,1932) and GOLVAN (1960) have retaiend the genus *Filicollis* under Polymorphidae but the sexual dimorphism and the presomal organisation in its species is a factor which qualifies this genus to be retained under its own family.

PETROCHENKO (1956) had assigned Filicollidae to the order Gigantorhynchida and YAMAGUTI (1963) placed it under Echinorhynchidea. The affinities of Filicollis with the order Palaeacanthocephala are, however, infallible and therefore the family Filicollidae PETROCHENKO,1956, emended, is assigned to this order.

(22) <u>Family Corynosomatidae SOUTHWELL & MACFIE, 1925</u> :

<u>Corynosoma</u> LUHE, 1905 and <u>Bolbosoma</u> PORTA, 1908 are the two principal Palaeacanthocephalan genera whose species chiefly occur in aquatic mammals - pinnipedians as well as cetaceans, and thus these parasites constitute a natural group of themselves. SOUTHWELL & MACFIE (1925) accorded due recognition to this host-parasite relationship and created the family Corynosomidae (sic) to accommodate these two genera. MEYER (1931, 1932), however, gave more weight to anatomical features and classified both these genera under Polymorphinae of the family Polymorphidae, essentially on the basis of the presence of cuticular spines on the fore-trunk though these spines extend more ventrally than dorsally, and continue unfailingly right upto and around the genital pore in <u>Corynosoma</u> and are more typically disposed on the anterior cone of <u>Bolbosoma</u>.

WITENBERG (1932), apparently unaware of Southwell & Macfie's proposal, created the subfamily Corynosominae for these two genera and affiliated it with Echinorhynchidae. PETROCHENKO (1956) proposed Corynosominae as a new subfamily and placed it under Polymorphidae and retained the same two genera within this subfamily. YAMAGUTI (1963) emended the subfamily name as Corynosomatinae and attributed it to PETROCHENKO (1956) but VAN CLEAVE (1953) and GOLVAN (1960) have not recognised Corynosomatidae and have, instead, placed <u>Corynosoma</u> and <u>Bolbosoma</u> under the family Polymorphidae although the former author has considerably emphasised the synecological peculiarities as well as the chief anatomical features of these two genera in the extensive analysis of these groups.

On morphological grounds, Corynosoma as well as Bolbosoma are markedly distinguished from all the other Palaeacanthocephalan genera and are readily distinguishable from the Polymorphid genera essentially through the general shape of the body and the extent of trunk spination which is manifested in typical patterns in each. The trunk is characteristically swollen and dorsally convex, anteriorly broadened, posteriorly tapering, ventrally flattened or discoid with trunk spines extending upto the genital orifice in Corynosoma. The proboscis is usually inclined postero-ventrally and is invariably overlapped by the recumbent portion of the fore-trunk. The lemniscis are short lobe-like and the cement glands are small and pyriform. In Bolbosoma the trunk is more elongated, usually bottle-shaped with anterioe region being distinctly set-off from the remainder, thence being attentaed, continued through a narrow tubular extension, becoming further modified into a circular muscularised biconvex fore-trunk ornamented with larger cuticular spines disposed in radial rows. The proboscis is relatively short and is borne vertically over the muscularised fore-trunk cone. The lemnisci are long, slender, tubular or filamentous and in certain species they extend almost upto the posterior extremity. The number of cement glands has been cited as two in most species but the present author has observed four long tubular glands in B. turbinella (DIESING, 1851) and B. nipponicum YAMAGUTI, 1939. Thus morphologically these two genera are not very closely related and essentially on this basis MACHADO FILHO (1964) proposed the subfamily Bolbosomatinae for the reception of the genus <u>Bolbosoma</u> though he assigned the former to Polymorphidae.

The present author entirely agrees with MACHADO FILHO (1964) in creating a separate subfamily for <u>Bolbosoma</u> since it is not tenable under Corynosomatinae chiefly on account of the morphological contrast it offers against <u>Corynosoma.</u>

It is, therefore, proposed that these two genera, viz., <u>Corynosoma</u> and <u>Bolbosoma</u> should be retained under two separate subfamilies ; <u>Corynosoma</u> under Corynosomatinae WITENBERG, 1932, emended, as restricted with the removal of the concept of the other genera, and <u>Bolbosoma</u> under Bolbosomatinae MACHADO FILHO, 1964, and these two families should be included within the family <u>Cory</u>nosomatidae WITENBERG, 1932, with Corynosomatinae as its nominate subcategory. Corynosominae PETROCHENKO, 1956 is here considered as a synonym of Corynosomatidae SOUTHWELL & MACFIE, 1925 for the former imbibes the concepts of both genera.

(23) <u>Family Plagiorhynchidae GOLVAN, 1960</u> :

GOLVAN (1960) proposed this family to include certain Palaeacanthocephalan genera which are essentially parasitic in birds, except one genus, <u>Sphaerechinorhynchus</u> JOHNSTON, 1929, whose species parasitize snakes. Plagiorhynchidae has been divided by GOLVAN (1960) into three subfamilies : (1) Plagiorhynchinae MEYER,1931, (ii) Sphaerechinorhynchinae GOLVAN,1960 and Porrorchinae GOLVAN,1956. Plagiorhynchinae was originally proposed by MEYER (1931) to contain the genra *Plagiorhynchus* LUHE, 1911, *Prosthorhynchus* KOSTYLEW,1915, *Sphaerechinorhynchus* JOHNSTON,1929, *Oligoterorhynchus* MONTICELLI,1914, *Lueheia* TRAVASSOS, 1919 and *Porrorchis* FUKUI,1929 but GOLVAN (1956) placed the first two of these genera in Plagiorhynchinae, the third one in Sphaerechinorhynchinae and the rest , along with *Pseudogordiorhynchus* GOLVAN, 1957 under Porrorchinae.

YAMAGUTI (1963) splitted Plagiorhynchidae into two diverse families, Plagiorhynchidae GOLVAN,1960, s.s., and Prosthrohynchidae PETROCHENKO,1956 ; the former was assigned to Echinorhynchidea by him and the latter to Gigantorhynchidea. In Plagiorhynchidae, YAMAGUTI (1963) retained the subfamilies Plagiorhynchinae, with the genera *Plagiorhynchus*, *Oligoterorhynchus*, *Pseudogordiorhynchus* and *Lueheia* and in Sphaerechinorhynchinae he contained *Sphaerechinorhynchus* only whereas in Prosthorhynchidae, which was assigned to an entirely different order - Gigantorhynchidea, YAMAGUTI (1963) included thegenera *Prosthorhynchus*, *Porrorchis* and *Pseudoporrorchis* JOYEUX & BAER,1935 and thus rendered the taxonomy of this group of Palaeacanthocephalan genera to chaos and confusion.

This confusion and discrepancy has been alleviated by SCHMIDT & KUNTZ (1966) who have declared *Prosthorhynchus* KOSTYLEW, 1915 as a junior synonym of *Plagiorhynchus* LUHE,1911 and have thus eliminated the family Prosthorhynchidae although they have retained Porrorchinae under Plagiorhynchidae (vide SCHMIDT & KUNTZ,1967).

The diagnostic features through which Plagiorhynchidae is differentiated from its closely related groups are : (a) insertion of the proboscis receptacle at the base of the proboscis, as in *Echinorhynchus*, (b) obliterated neck, and (c) long slender lemnisci often extending much beyond the receptacle. These characters are consistent in all the genera assigned to Plagiorhynchidae by YAMAGUTI (1963), GOLVAN (1960) as well as by SCHIMIDT & KUNTZ (1966) except in *Pseudoluehia* SCHMIDT & KUNTZ,1967 which, in possessing a distinct neck, anterior insertion of the receptacle and short spatulate lemnisci, agrees with the definition of Porrorchinae and is assigned to it in the present study. *Sphaerechinorhynchyrhynchus* also conforms with the concept of Plagiorhynchidae except that the proboscis is short spheroidal in its constituent species and for this reason alone this genus is aptly ascribed to a different subfamily.

With this consistency of characters in view, Plagiorhynchidae is divided into two subfamilies : (a) Plagiorhynchinae MEYER,1931, the nominal type, comprising the genera : (i) *Plagiorhynchus* LUHE,1911 (= *Prosthorhynchus* KOSTYLEW,1915), (ii) *Lueheia* TRAVASSOS,1919, (iii) *Oligoterorhynchus* MONTICELLI,1914 and (iv) *Pseudogordiorhynchus* GOLVAN,1957, and, (b) : Sphaerechine - rhynchinae GOLVAN,1960,with the sole genus *Sphaerechinorhynchus* JOHNSTON,1929, the nominal type.

(24) <u>Family Centrorhynchidae VAN CLEAVE,1916</u> :

Centrorhynchidae was proposed by VAN CLEAVE (1916) to accommodate the genera <u>Centrorhynchus</u> LUHE,1911 and <u>Mediorhynchus</u> VAN CLEAVE,1916 but the latter genus was subsequently transferred to the family Gigantorhynchidae in the order Archiacanthocephala. TRAVASSOS (1926) and, later, MEYER (1931) suppressed it as the subfamily Centrorhynchinae ; the former author having placed it under Echinorhynchidae and the latter, under Polymorphidae. PETROCHENKO (1956,1958) also considered Centrorhynchinae a subfamily of Gigantorhynchidae and referred these taxa to the order Gigantorhynchida. YAMAGUTI (1963), however, retained the family Centrorhynchidae, with the genus <u>Centrorhynchus</u> only, but he too placed this family under the order Gigantorhynchidea. GRABDA-KAZUBSKA (1967) has, however, objected to the relegation of Centrorhynchidae to Gigantorhynchidea and has re-aligned it (Centrorhynchidae) with Palaeacanthocephala. GOLVAN (1960) has proposed Centrorhynchidae as a new family but this is preposterous since the family name was already proposed by VAN CLEAVE (1916) much earlier and the validity of its concept is unquestionable.

The principal diagnostic feature of Centrorhynchidae is the demarcation of the presoma into an anterior proboscis and the posterior neck which may be spinose or smooth; the two regions being demarcated by the insertion of the proboscis receptacle in the anterior middle of the presoma. The spination of the neck region is a character of subfamilial value and accordingly the two constituent subfamilies, Porrorchinae GOLVAN,1956 and Centrorhynchinae TRAVASSOS,1926 are differentiated from each other on the basis of this character alone; Porrorchinae is characterised by the absence of spines on the neck region whereas Centrorhynchinae is distinguished by the presence of large, quincunxially arranged arcuate spines over the neck.

Porrorchinae initially contaiend the genera Porrorchis FUKUI,1929, Pseudoporrorchis JOYEUX & BAER,1935, Lueheia TRAVASSOS,1919 and Oligoterorhynchus MONTICELLI,1914 but later on Pseudogordiorhynchus GOLVAN,1957 was also added to it. Among these genera only Porrorchis is tenable within this subfamily since Pseudoporrorchis has been declared synonym of the former genus by SCHMIDT & KUNTZ (1967) ; the other genera are relegated to Plagiorhynchidae by virtue of their presomal organization. Two more genera, Owilfordia SCHMIDT & KUNTZ,1967 and Pseudolueheia SCHMIDT & KUNTZ,1967 are ascribed to Porrorchinae since they entirely conform with the concept of this subfamily and one more genus, Porrorchoides, described as a new taxon in the present study, is added to this group. Porrorchoides is closely related to Porrorchis as well as Pseudolueheia but differs from both in the shape and size of the body, in having long slender and tubular lemnisci and in possessing four short tubular spirally rolled cement glands which are found in a helical pattern in its type species, Porrorchoides texeres, n. gen et sp.

Centrorhynchinae of TRAVASSOS (1926) was a variegated assemblage of as many as ten diverse genera and the group comprised spinose as well as aspinose forms ; even _Corynosoma_, _Bolbosoma_, _Arhythmorhynchus_ and _Filicollis_ were included in that subfamily by TRAVASSOS (1926). MEYER (1931), however, restricted Centrorhynchinae to _Centrorhynchus_ LUHE, 1911 and _Gordiorhynchus_ MEYER, 1931 but the latter genus has been considered congeneric with the former by all subsequent workers.

The genus Centrorhynchus was first divided into two subgenera, _Centrorhynchus_ and _Sphaerirostris_, by GOLVAN (1956) and the latter subgenus was subsequently raised by him as a distinct genus later on (GOLVAN, 1960). These two were differentiated from each other essentially on the basis of the shape of the proboscis - elongated or claviform in the former and oval or ellipsoidal in the latter, and also through the general shape of the trunk; elongated in _Centrorhynchus_ and fusiform in _Sphaerirostris_ but there are already so many transitional forms which do not exactly conform with any of these two if their characterisation is strictly adhered to. Under such circumstances it would therefore be necessary to create a number of subgenera or genera for such transitional form and this would obviously be an unwarrented act. Retaining the species assigned to _Sphaerirostris_ by GOLVAN (1956) within the genus _Centrorhynchus_ neither diturbs the latter's systematic position nor does it interfere with the validity of any of the species and it, therefore, seems reasonable to unify the two concepts ; of _Centrorhynchus_ (s.g) and _Sphaerirostris_ (s.g) and their corresponding species be retained within the genus Centrorhynchus LUHE,1911.

The family Centrorhynchidae VAN CLEAVE,1916 thus comprises the two subfamiles : (a) Porrorchinae GOLVAN,1956, which contains the genera : (i) Porrorchis Fukui,1929 (= Pseudoporrorchis JOYEUX & BAER,1935), (ii) Pseudolueheia SCHMIDT & KUNTZ,1967, (iii) Owilfordia SCHMIDT & KUNTZ,1967 and (v) Porrorchoides, n. gen., and (b) Centrorhynchinae TRAVASSOS (= Centrorhynchinae MEYER,1931) which contains the genus Centrorhynchus LUHE,1911 (= Gordiorhynchus MEYER,1931 ; = Sphaerirostris GOLVAN,1956) only.

The concept of the family Centrorhynchidae instituted by VAN CLEAVE (1916) retains priority and accordingly Centrorhynchidae WITENBERG,1932 and Centrorhynchidae GOLVAN,1960 are considered its synonyms.

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(VI)

Conclusion

The present study is concluded with a revised and an up-to-date scheme of classification of the orders Eoacanthocephala and Palaeacanthocephala formulated in context with the foregoing discussions (Chapter V) on the systematic evaluation of various generic and supra-generic categories of these two orders.

The scheme thus formulated is as follows :

(A) Order Eoacanthocephala VAN CLEAVE,1936

(I) Suborder Gyracanthocephala VAN CLEAVE,1936

(1) Family Quadrigyridae VAN CLEAVE,1920

(i) Genus *Quadrigyrus* VAN CLEAVE,1920

(ii) Genus *Palliolisentis* MACHADO FILHO,1951

(2) Family Acanthogyridae THAPAR,1927

(i) Genus *Acanthogyrus* THAPAR,1927

(ii) Genus *Acanthosentis* VERMA & DATTA,1929

(iii Genus *Raosentis* DATTA,1947

(iv) Genus *Acanthocephalorhynchoides* KOSTYLEW,1941

(3) Family Pallisentidae VAN CLEAVE,1928

(i) Genus *Pallisentis* VAN CLEAVE,1928

(II) Suborder Neoacanthocephala VAN CLEAVE,1936

(1) Family Neoechinorhynchidae TRAVASSOS,1917

(a) Subfamily Neoechinorhynchinae TRAVASSOS,1926

(i) Genus Neoechinorhynchus HAMANN,1905

(ii) Genus Octospinifer VAN CLEAVE,1919

(iii) Genus Hebesoma VAN CLEAVE,1928

(iv) Genus Hexaspiron DOLLFUS & GOLVAN,1956

(v) Genus Zeylanechinorhynchus FERNANDO & FURTADO,1963

(vi) Genus Dendronucleata SOKOLOWSKAIA,1967

(vii) Genus Gorytocephalus NICKOL & THATCHER,1972

(b) Subfamily Gracilisentinae PETROCHENKO,1956

(i) Genus Gracilisentis VAN CLEAVE,1919

(ii) Genus Octospiniferoides BULLOCK,1957

(c) Subfamily Atactorhynchinae PETROCHENKO,1956

(i) Genus Atactorhynchus CHANDLER,1937

(ii) Genus Floridosentis WARD,1953

(iii) Genus Paulisentis VAN CLEAVE & BANGHAM,1949

(iv) Genus Microsentis MARTIN & MULTANI,1966

(v) Genus Pandosentis VAN CLEAVE,1920

(d) Subfamily Eocollinae PETROCHENKO,1956

(i) Genus Eocollis VAN CLEAVE,1947

(2) Family Tenuisentidae VAN CLEAVE,1936

(i) Genus Tenuisentis VAN CLEAVE,1936

(ii) Genus Tanaorhamphus WARD,1918

(B) Order Palaeacanthocephala MEYER, 1931

(1) Family Diplosentidae TUBANGUI & MASILUNGAN, 1937

(i) Genus Diplosentis TUBANGUI & MASILUNGAN, 1937

(ii) Genus Pararhadinorhynchus JOHNSTON & EDMONDS, 1947

(2) Family Acanthodeltidae n. fam.

(i) Genus Acanthodelta DIAZ-UNGRIA & GRACIA RODRIGO, 1958

(3) Family Gorgorhynchidae VAN CLEAVE & LINCICOME, 1940

(i) Genus Gorgorhynchus CHANDLER, 1934

(ii) Genus Gorgorhynchoides CABLE & LINDEROTH, 1963

(iii) Genus Australorhynchus LEBEDEV, 1967

(iv) Genus Pseudauchen YAMAGUTI, 1963

(v) Genus Furtadosentis n. gen.

(4) Family Rhadinorhynchidae TRAVASSOS, 1923

(a) Subfamily Allorhadinorhynchinae GOLVAN, 1969

(i) Genus Allorhadinorhynchus YAMAGUTI, 1959

(b) Subfamily Rhadinorhynchinae LUHE, 1912

(i) Genus Rhadinorhynchus LUHE, 1911

(ii) Genus Nipporhynchus CHANDLER, 1934

(iii) Genus Megistacantha GOLVAN, 1960

(iv) Genus Cathyacanthus GOLVAN, 1969

(v) Genus Paragorgorhynchus GOLVAN, 1957

(5) Family Illiosentidae GOLVAN, 1960

(i) Genus Illiosentis VAN CLEAVE & LINCICOME, 1939

(ii) Genus *Telosentis* VAN CLEAVE, 1923

(iii) Genus *Tegorhynchus* VAN CLEAVE, 1921

(iv) Genus *Pseudorhadinorhynchus* ACHMEROV & D-ACHMEROVA, 1941

(v) Genus *Metarhadinorhynchus* YAMAGUTI, 1959

(vi) Genus *Dollfusentis* GOLVAN, 1969

(6) Family Serrasentidae PETROCHENKO, 1956. n. grad.

(i) Genus *Serrasentis* VAN CLEAVE, 1923

(7) Family Polyacanthorhynchidae PETROCHENKO, 1956. n. grad.

(i) Genus *Polyacanthorhynchus* TRAVASSOS, 1920

(ii) Genus *Proterhadinorhynchus* PETROCHENKO, 1956

(8) Family Micracanthorhynchinidae YAMAGUTI, 1963

(i) Genus *Micracanthorhynchina* (HARADA, 1935)

(ii) Genus *Mehrarhynchus* DATTA, 1940

(iii) Genus *Neoacanthocephaloides* CABLE & QUICK, 1954

(iv) Genus *Yamagutisentis* GOLVAN, 1969

(v) Genus *Paracanthorhynchus* EDMONDS, 1967

(9) Family Arhythmacanthidae YAMAGUTI, 1935

(i) Genus *Arhythmacanthus* YAMAGUTI, 1935

(10) Family Aspersentidae GOLVAN, 1960

(i) Genus *Aspersentis* VAN CLEAVE, 1929

(ii) Genus *Heterosentis* VAN CLEAVE, 1931

(11) Family Heteracanthocephalidae PETROCHENKO, 1956

(i) Genus *Heteracanthocephalus* PETROCHENKO, 1956

(ii) Genus *Sachalinorhynchus* KROTOV & PETROCHENKO, 1956

(12) Family Filisomatidae VAN CLEAVE, 1928

(i) Genus *Filisoma* VAN CLEAVE, 1928

(ii) Genus *Parafilisoma* n. gen.

(13) Family Cavisomatidae VAN CLEAVE, 1931

(i) Genus *Cavisoma* VAN CLEAVE, 1931

(ii) Genus *Paracavisoma* KRITSCHER, 1957

(iii) Genus *Pseudocavisoma* GOLVAN & HOUIN, 1964

(iv) Genus *Megapriapus* GOLVAN, DIAZ-UNGRIA & RODRIGO, 1964

(v) Genus *Neorhadinorhynchus* YAMAGUTI, 1935, n. grad.

(vi) Genus *Rhadinorhynchoides* FUKUI & MORISHITA, 1937

(vii) Genus *Echinorhynchoides* ACHMEROV & D-ACHMEROVA, 1941

(14) Family Fessisentidae VAN CLEAVE, 1931

(i) Genus *Fessisentis* VAN CLEAVE, 1931

(15) Family Hypoechinorhynchidae GOLVAN, 1960

(i) Genus *Hypoechinorhynchus* YAMAGUTI, 1939

(16) Family Mirzasentidae , n. fam.

(i) Genus *Mirzasentis* n. gen.

(17) Family Echinorhynchidae COBBOLD, 1879

(a) Subfamily Echinorhynchinae TRAVASSOS, 1920

(i) Genus *Echinorhynchus* MULLER, 1776

(ii) Genus *Acanthocephalus* KOELREUTHER, 1771

(iii) Genus *Paracanthocephalus* ACHMEROV & D-ACHMEROVA, 1941

(iv) Genus *Bolborhynchoides* ACHMEROV, 1959

(v) Genus *Rusetacanthus* GOLVAN & HOUIN, 1964

(vi) Genus *Metacanthocephaloides* YAMAGUTI, 1959

(b) Subfamily Paracanthocephaloidinae GOLVAN, 1969

(i) Genus *Acanthocephaloides* MEYER, 1932

(ii) Genus *Breziacanthus* GOLVAN, 1969

(18) Family Leptorhynchoididae WITENBERG, 1932

(i) Genus *Leptorhynchoides* KOSTYLEW, 1924

(ii) Genus *Metacanthocephalus* YAMAGUTI, 1959

(19) Family Pomphorhynchidae YAMAGUTI, 1939

(i) Genus *Pomphorhynchus* MONTICELLI, 1905

(ii) Genus *Longicollum* YAMAGUTI, 1935

(iii) Genus *Tenuiproboscis* YAMAGUTI, 1935

(20) Family Polymorphidae MEYER, 1931

(i) Genus *Polymorphus* LUHE, 1911

(ii) Genus *Arhythmorhynchus* LUHE, 1911

(iii) Genus *Skrjabinorhynchus* PETROCHENKO, 1956

(iv) Genus *Hexaglandula* PETROCHENKO, 1956

(v) Genus *Diplospinifer* FUKUI, 1929

(21) Family Filicollidae PETROCHENKO, 1956

(i) Genus *Filicollis* LUHE, 1911

(22) Family Corynosomatidae SOUTHWELL & MACFIE, 1925

(a) Subfamily Corynosomatinae WITENBERG, 1932

(i) Genus *Corynosoma* LUHE,1911

(b) Subfamily Bolbosomatinae MACHADO FILHO,1964

(i) Genus *Bolbosoma* PORTA,1908

(23) Family Plagiorhynchidae GOLVAN,1960

(a) Subfamily Plagiorhynchinae MEYER,1931

(i) Genus *Plagiorhynchus* LUHE,1911

(ii) Genus *Lueheia* TRAVASSOS,1919

(iii) Genus *Oligoterorhynchus* MONTICELLI,1914

(iv) Genus *Pseudogordiorhynchus* GOLVAN,1957

(b) Subfamily Sphaerechinorhynchinae GOLVAN,1960

(i) Genus *Sphaerechinorhynchus* JOHNSTON,1929

(24) Family Centrorhynchidae VAN CLEAVE,1916

(a) Subfamily Porrorchinae GOLVAN,1956

(i) Genus *Porrorchis* FUKUI,1929

(ii) Genus *Porrorchoides* n. gen.

(iii) Genus *Pseudoluehia* SCHMIDT & KUNTZ,1967

(iv) Genus *Owilfordia* SCHMIDT & KUNTZ,1967

(b) Subfamily Centrorhynchinae TRAVASSOS,1926

(i) Genus *Centrorhynchus* LUHE,1911.

Key to the generic and supra-generic categories of the Orders Eoacanthocephala and Palaeacanthocephala

(A) Order Eoacanthocephala

(1) a : Principal lacunar canals dorsal and ventral; proboscis receptacle single layered; cement gland single, syncytial, with a cement reservoir; ligament sacs persistent, dorsal and ventral; eggs thin shelled .... Order Eoacanthocephala (2)

b : Principal lacunar canals lateral; proboscis receptacle single or double layered; cement glands multiple, 2-8, follicular or tubular, cement reservoir wanting ; ligament sacs intermittent; eggs with thicker middle-shell mostly with polar bulbs .... Order Palaeacanthocephala (B)

(2) a : Trunk beset with cuticular spines .... Suborder Gyracanthocephala (3)

b : Trunk smooth, devoid of cuticular spines .... Suborder Neoacanthocephala (9)

(3) a : Proboscis with 3-6 radial, transverse or longitudinal rows of hooks; trunk spines minute with stellate bases, in a single field which may be restricted or extensive.. .... (4)

b : Proboscis with 4 transverse rows of hooks; trunk spines b : large, Y-shaped, in two successive spinose fields, interrupted from each other by a narrow aspinose gap .... Family Pallisentidae, ... Genus <u>Pallisentis</u>.

(4) a : Proboscis with 4-6 transverse or longitudinal rows of hooks; trunk spines in a few (4-5) circular rows; posterior hypodermic nuclei large, dendritic; in Neotropical carps .... Family Quadrigyridae (5)

b : Proboscis with 3-4 transverse rows of hooks ; trunk-spines in numerous rows, often reaching posterior extremity of the trunk ; hypodermic nuclei minute, oval or elliptical .... Family Acanthogyridae (6)

(5) a : Proboscis spherical, armed with four transverse rows of hooks .... Genus <u>Quadrigyrus</u>

b : Proboscis subcylindrical, armed with 6 longitudinal rows of hooks .... Genus <u>Palliolisentis</u>

(6) a : Proboscis hooks in three transverse rows .... (7)

b : Proboscis hooks in four transverse rows .... (8)

(7) a : Apicals broad and heavy, thick-set; trunk spines extensive; genital spines present in both sexes; parasitic in carps of the genus <u>Labeo</u> only .... Genus <u>Acanthogyrus</u>

b : Apicals slender; trunk spines not extending beyond mid-body length .... Genus <u>Acanthosentis</u>

(8) a : Apicals and sub-apicals large, alike, basals smaller, equal in size; trunk spines in 10-20 anterior circular rows .... Genus <u>Raosentis</u>

b : Apicals largest; in single transverse row; sub-apicals and basals gradually decreasing in size; trunk spines more extensive ventrally than dorsally .... Genus <u>Acanthocephalorhynchoides</u>.

(9) a : Proboscis oval or sub-cylindrical, with relatively a few radial or diagonal rows of hooks; nuclear constancy distinct in some genera .... Family Neoechinorhynchidae .... (10)

b : Proboscis elongate cylindrical, with numerous longitudinal rows of hooks of uniform size .... Family Tenuisentidae (23)

(10) a : Proboscis with 3 transverse rows of hooks; fore-trunk narrow, elongated, modified into a bulbous expansion distally .... Subfamily Eocollinae, ... Genus <u>Eocollis</u>.

b : Proboscis hooks in 3 or more transverse of diagonal rows : fore-trunk rounded, no modification .... (11)

(11) a : Proboscis armed with 3 transverse rows of sigmoid hooks projecting only a little from the cuticle .. .. Subfamily Gracilisentinae (12)

b : Proboscis spherical or oval, with 3 or more transverse or diagonal rows of hooks; apicals largest .... (13)

(12) a : Proboscis with 3 tmansverse rows of 12 hooks each; hooks sigmoid .... Genus Gracilisentis

b : Proboscis with 3 transverse rows of 8 hooks each; roots longer, vertical ..... Genus Octospiniferoides

(13) a : Proboscis short, globular or sub-spherical, with 3-4 transverse rows of hooks, apicals largest, trunk short or longer, hypodermic nuclei larger.......... .... Subfamily Neoechinorhynchinae (14)

b : Proboscis short, sub-cylindrical, hooks in diagonal rows; posterior hooks much smaller than anteriors ... . Subfamily Atactorhynchinae (20)

(14) a : Proboscis hooks in 3 transverse rows .... (15)

b : Proboscis hooks in 4 transverse rows .... (19)

(15) a : 8 hooks in each of the 3 transverse rows or 3 hooks each in 8 oblique rows .... Genus Octospinifer

b : 6 hooks in eachof the 3 transverse rows of 3 hooks in each of the 6 oblique rows .... (16)

(16) a : Trunk attenuated, oval, hypodermal musculature markedly thick; apicals longer, slender; eggs with polar bulbs on middle shell............. Genus Hebesoma

b : Trunk slender, hypodermal musculature moderate, egg shells without polar bulbs .... (17)

(17) a : Hypodermic nuclei numerous, dendritic, stellate ... . Genus Dendronucleata

b : Hypodermic nuclei oval or elliptical; 5 dorsal and one ventral; proboscis receptacle with a sling or not ... . (18)

(18) a : Sling present; ventro-laterally split, trunk with a dorsal cuticular crest ..... Genus Gorytocephalus

b : Sling wanting; trunk smooth, elongate, fusiform or cylindrical .... Genus Neoechinorhynchus

(19) a : Body fairly long, cylindrical, neck short, truncated, 6 hooks in each of the 4 transverse rows or 4 in each of the 6 oblique rows .... Genus Hexaspiron

b : Trunk short, fusiform; neck long; 7 hooks in each of the 4 transverse rows .... Genus Zeylanechinorhynchus

(20) a : Trunk long, slender or stout, more than 10 mm long, proboscis with 8-10 diagonal rows of hooks gradually decreasing in size antero-posteriorly; apical organ elongate tubular .... Genus Floridosentis

b : Trunk short, fusiform; much smaller (less than 5 mm) : Proboscis hooks of two distinct types; basals twice as many as anteriors or the same in number, becoming either gradually, or, abruptly, smaller in size than the latter .... (21)

(21) a : Proboscis with 6 oblique rows of 5 hooks each, gradually decreasing in size antero-posteriorly .... Genus Paulisentis

b : Proboscis with 8 oblique rows of 8 hooks each ; basals twice more; abruptly smaller in size .... Genus Atactorhynchus

c : Proboscis larger, with more than 10 oblique rows of hooks of variable length .... (22)

(22) a : Proboscis ellipsoidal, proboscis hooks in 16-20 longitudinal rows; trunk short, fusiform; 5 hooks in each longitudinal row; in marine fishes .... Genus Microsentis.

b : Proboscis sub-cylindrical, proboscis hooks in 22 longitudinal rows of 4 hooks each; trunk small, elongate, parasitic in Neotropical fresh-water fishes .... Genus Pandosentis

(23) a : Proboscis sub-terminal; cement gland fairly long, tubular .... Genus Tenuisentis

b : Proboscis vertical and terminal; cement gland short, saccular .... Genus Tanaorhamphus.

(B) Order Palaeacanthocephala

(1) a : Palaeacanthocephala parasitic in fishes .... (2)

b : Palaeacanthocephala chiefly parasitic in birds and aquatic mammals .... (51)

(2) a : Trunk adorned with cuticular spines; proboscis receptacle single or double layered .... (3)

b : Trunk smooth, without cuticular spines; proboscis receptacle double layered .... (26)

(3) a : Proboscis long, cylindrical, Proboscis receptacle single layered............. Family Polyacanthorhynchidae (4)

b : Proboscis elongate or claviform, proboscis receptacle double layered .... (5)

(4) a : Proboscis long, claviform, with numerous rows of hooks, cement glands 8, fairly long, tubular; parasitic in crocodiles of Neotropical region .... Genus <u>Polyacanthorhynchus</u>

b : Proboscis elongate, cylindrical, with 10-15 longitudinal rows of hooks; fore-trunk with a few scattered spines; cement glands 4, short fusiform follicles; in marine fishes of Japan .... Genus <u>Proterhadinorhynchus</u>

(5) a : Proboscis globose or spheroidal; hooks distinguished as apicals, medians and basals; apicals realtively smaller, in transverse or diagonal rows; trunk short fusiform or elongate cylindrical; cement glands 4-6, pyriform, or elongate, tubular .... (6)

b : Proboscis claviform or cylindrical; hooks in numerous longitudinal rows, with or without dorso-ventral differentiation; lemnisci elongate tubular or short digitiform; trunk fusiform or elongated; trunk spines extensive or restricted .... (7)

(6) a : Body elongated, cylindrical; proboscis with 8 oblique rows of 3 hooks each; basals largest, tusk-shaped; fore-trunk with a few circular rows of spines; cement glands 4, long, tubular .... Family Acanthodeltidae
.... Genus <u>Acanthodelta</u>

b : Trunk short fusiform; fore-trunk with circular rows of spines extending upto mid-body region; proboscis globular, with 6 radial rows of 3 hooks each, median hooks larger, strongly curved; 6 short pyriform cement glands ....
.... Family Arhythmacanthidae
.... Genus <u>Arhythmacanthus</u>

(7) a : Proboscis short, cylindrical or claviform; trunk spines minute, more extensive ventrally than dorsally; lemnisci short, digitiform or heavy club-shaped; cement glands 4-6, pyriform .... Family Micracanthorhynchinidae (8)

b : Proboscis long or short, slender or massive; trunk spines in circular rows or modified; trunk elongated or fusiform, cement glands 4-8; long tubular or short follicular; proboscis hooks uniform or dissimilar dorso-ventrally.....
.... (11)

(8) a : Proboscis sub-cylindrical with few hooks (12 longitudinal rows); trunk spines restricted to a short triangular ventral field; 4 short pyriform cement-glands .... Genus <u>Paracanthorhynchus</u>

b : Proboscis oval, claviform or cylindrical; slender or massive; trunk spines in circular rows or more extensive ventrally than dorsally, basal hooks of each row much smaller than anteriors or, all hooks of the same size, or gradually decreasing in size .... (9)

(9) a : Proboscis oval; neck distinct, large, truncate conical, lemnisci digitiform, as long as proboscis receptacle; trunk spines minute, in a few anterior circular rows; cement glands 6 pyriform follicles .... Genus <u>Yamagutisentis</u>

b : Proboscis claviform or cylindrical, massive or slender; trunk spines minute or large; lemnisci digitiform or elongate tubular .... (10)

(10) a : Proboscis short, claviform; trunk spines minute; more extensive ventrally than dorsally; lemnisci fusiform or club-shaped; cement glands 4-6, short pyriform ... . Genus <u>Micracanthorhynchina</u>

b : Proboscis cylindrical, massive; hooks gradually decreasing in size; fore-trunk attenuated; spines large, spinose region constricted; lemnisci long, tubular .... Genus [illegible] c : Proboscis elongate slender, cylindrical; basals of each row abruptly smaller than anteriors; trunk spines extensive, often reaching posterior region; lemnisci digitiform, slightly longer than proboscis receptacle; 6 pyriform cement glands .... Genus Neoacanthocephaloides

(11) a : Proboscis medium sized, claviform; dorsal hooks much smaller than ventrals; dis-symmetry pronounced; basal corona wanting ....Family Aspersentidae (12)

b : Proboscis short, cylindrical; trunk fairly long; hooks alike, basal corona wanting; lemnisci long, tubular, reaching past testes .... (13)

c : Proboscis elongate cylindrical with dorso-ventral differentiation in shape and size of hooks distinct or indistinct; basal corona complete or crescentic ... . (17)

(12) a : Trunk short, fusiform; lemnisci digitiform, shorter than proboscis receptacle .... Genus Aspersentis

b : Trunk elongate slender; proboscis claviform; lemnisci tubular; extending far beyond the proboscis receptacle .... Genus Heterosentis

(13) a : Proboscis cylindroid, massive; fore-trunk with few oblique rows of larger spines, followed by numerous ventral fringed 'combs'; 4 long, tubular cement glands .... Family Serrasentidae .... Genus <u>Serrasentis</u>

b : Proboscis short, cylindrical or claviform, fore-trunk with numerous larger spines in a single field; 4 long tubular cement glands .... Family Gorgorhynchidae (14)

(14) a : Proboscis spheroidal; crowded with hooks; neck cylindrical, as long as the proboscis; fore-trunk densely spinose; spines laregr, sigmoid; testes wide apart; in fresh-water fishes of Oriental region .... Genus <u>Furtadosentis</u>

b : Proboscis elongate, fusiform with a large false-neck- the pseudocollum - which is broader posteriorly; trunk wider in the anterior middle, thence becoming narrow, tapering; fore-trunk spareely spinose .... Genus <u>Pseudauchen</u>

c : Proboscis shorter, claviform, trunk anteriorly modified or not .... (15)

(15) a : Proboscis club-shaped, wider distally; anterior larger hooks with lateral spurs; 4 long tubular lemnisci, 4 elongate tubular cement glands; anterior trunk spinose .... Genus <u>Australorhynchus</u>

b : Proboscis short cylindrical or claviform; fore-trunk modified or not; 2 lemnisci ....(16)

(16) a : Fore-trunk with a dorsal inflated hump which may be spinose; trunk spines densely situated on an anterior narrow region; proboscis claviform; hooks gradually decreasing in size antero-posteriorly; 4-6 long tubular cement glands .... Genus <u>Gorgorhynchoides</u>

b : Fore-trunk spinose, distally rounded, no modification; proboscis short, sub-cylindrical; 4 long tubular cement glands .... Genus <u>Gorgorhynchus</u>

(17) a : Body cylindrical, often curved; smooth or pseudo-segmented; trunk spines usually in two fields; proboscis elongate, slender with dorso-ventral differentiation of hooks; basal corona complete; lemnisci digitiform; shorter, usually half as long as the proboscis receptacle; 4 tubular cement glands ...., Rhadinorhynchidae (18)

b : Proboscis long, slender with indistinct dorso-ventral differentiation; spinose fore-trunk narrower; basal corona crescentic; 8 follicular cement glands .... Family Illiosentidae (22)

(18) a : Proboscis clavate; trunk pseudosegmented; 2 claviform cement glands .... Subfamily Allorhadinorhynchinae .... Genus <u>Allorhadinorhynchus</u>

b : Trunk cylindrical; 4 tubular cement glnads; trunk spines in two fields; in circular rows anteriorly, random posteriorly; 4 cement glands partly overlapping each other .... Subfamily Rhadinorhynchinae (19)

(19) a : Parasitic in fresh-water fishes .... (20)

b : Parasitic in marine fishes .... (21)

(20) a : Proboscis excessively long; cylindrical; hooks uniformly distributed .... Genus <u>Cathyacanthus</u>

b : Proboscis short, cylindrical; trunk spines more extensive dorsally; cement glands short; tubular; in two tandem pairs; trunk claviform .... Genus <u>Paragorgorhynchus</u>

c : Proboscis elongate, slender, cylindrical; distal spines on fore-trunk smaller; proximal spines excessively large; in African fishes .... Genus <u>Megistacantha</u>

(21) a : Proboscis with distinct dorso-ventral differentiation; trunk spines larger; sparce; scattered over the fore-trunk .... Genus <u>Rhadinorhynchus</u>

b : Dorso-ventral differentiation of proboscis hooks moderate; trunk spines minute, in transverse rows; more extensive ventrally .... Genus <u>Nipporhynchus</u>

(22) a : Proboscis claviform; spinose fore-trunk narrow; lemnisci fairly long, tubular; cement glands in 4 pairs with fairly long ducts .... Genus <u>Metarhadinorhynchus</u>

b : Proboscis claviform or cylindrical; long or short; lemnisci of variable length; trunk spines dense anteriorly; genital spines present or wanting; posterior extremity with or without any modification ...... (23)

(23) a : Posterior extremity with genital spines; lemnisci short, digitiform .... Genus Telosentis

b : Posterior extremity of male with a muscular flap; of female with a fan-shaped organ and a few genital spines; lemnisci much longer than the proboscis receptacle .... Genus Illiosentis

c : Posterior extremities without any modification.....(24)

(24) a : Proboscis massive; hooks diverse; basal few crooked; invested with cuticular sheath all over the proboscis .... Genus Tegorhynchus

b : Proboscis long, slender, cylindrical or short, subcylindrical; spinose fore-trunk narrow; lemnisci filiform .... (25)

(25) a : Basal few hooks of each longitudinal row much smaller than the anteriors; trunk long, slender; basal corona on the ventral side .... Genus Dollfusentis

b : Trunk short, fusiform; proboscis short cylindrical; hooks alike; basal corona wanting .... Genus Pseudorhadinorhynchus

(26) a : Proboscis globular, ventroterminal, with three distinct types of hooks; trunk short, fusiform; apical hooks largest; cement glands 6; short, pyriform.......... ....Family Hypoechinorhynchidae .... Genus <u>Hypoechinorhynchus</u>

b : Body elongated; proboscis ellipsoidal or cylindrical; hooks numerous with or without dorso-ventral differentiation; lemnisci long, short, tubular or modified into a ring-like ruff; cement glands 2-6; pyriform follicles or tubular .... (27)

(27) a : Proboscis long, cylindrical; cement glands 2, elongated, tubular .... Family Diplosentidae (28)

b : Proboscis long or short; modified or not; cement glands 4-8, follicular or tubular .... (29)

(28) a : Proboscis short, claviform; lemnisci convoluted, half as long as the receptacle .... Genus <u>Diplosentis</u>

b : Proboscis elongate cylindrical; lemnisci digitiform, as long as the receptacle .... Genus <u>Pararhadinorhynchus</u>

(29) a : Proboscis elongated, claviform; proboscis hooks partly ensheatched; 8 follicular cement glands; hypodermic nuclei dendritic or oval .....Family Leptorhynchoididae .... (30)

b : Body cylindrical or fusiform; proboscis elongated or short cylindrical; may be swollen anteriorly; lemnisci long or short; cement glands 4-6, pyriform or tubular .... (31)

(30) a : Body elongated; proboscis hooks partly ensheathed; lemnisci fairly long; hypodermic nuclei large, dendritic, ... Genus <u>Leptorhynchoides</u>

b : Body fusiform; proboscis short, sub-cylindrical; lemnisci digitiform, as long as the proboscis receptacle...... .... Genus <u>Metacanthocephalus</u>

(31) a : Proboscis or neck variously modified as broadened or bulbous extensions; trunk fusiform or cylindroid; 6 pyriform cement glands ; lemnisci present or attenuated, ... Family Pomphorhynchidae (32)

b : Proboscis and neck without any modification; proboscis hooks with or without dorso-ventral differentiation; 4-6 cement glands .... (33)

(32) a : Proximal region of the neck inflated into a bulla; proboscis short, conical or subcylindrical; post-bulbar neck fairly long and slender .....Genus <u>Pomphorhynchus</u>

b : Proboscis short; neck much longer and uniformly widened; basally attenuated, fore-trunk broader; lemnisci digitiform or rudimentary .... Genus <u>Longicollum</u>

c : Trunk fusiform; neck long, wide; proboscis short, filiform; lemnisci digitiform, extending past the proboscis receptacle .... Genus <u>Tenuiproboscis</u>

(33) a : Body short, fusiform; proboscis elongated with marked dorso-ventral differentiation in hooks, ventrals broader, acute and thick, dorsals slender and arcuate .... Family Heteracanthocephalidae (34)

b : Proboscis elongated or short cylindrical or clavate without dorso-ventral differentiation of hooks; trunk elongate, cylindrical or short, fusiform .... (35)

(34) a : Proboscis short, sub-cylindrical; lemnisci longer than proboscis receptacle .... Genus <u>Heteracanthocephalus</u>

b : Proboscis elongated; lemnisci fusiform, not extending beyond receptacle .... Genus <u>Sachalinorhynchus</u>

(35) a : 4 cement glands in males .... (36)

b : 6 cement glands in males .... (44)

(36) a : Trunk fairly long, cylindrical; proboscis elongate, filiform; 4 long tubular cement glands............... .... Family Filisomatidae (37)

b : Trunk elongated or fusiform; proboscis short, cylindrical or modified; cement glands 4, short, pyriform or fusiform; testes long, tubular or short rounded ...(38)

(37) a : Trunk slender, cylindrical; lemnisci digitiform spatulate, as long as the proboscis receptacle .. .. Genus Filisoma

b : Trunk robust; pseudo-segmented; hypodermic musculature thick; lemnisci filiform, convoluted, much longer than the proboscis receptacle ...... Genus Parafilisoma

(38) a : Proboscis short, sub-cylindrical; trunk elongated; testes fairly long, cylindrical, tandem, occupying about 2/3 trunk length; cement glands 4, short, clavate or fusiform .... Family Fessisentidae, ... Genus Fessisentis

b : Proboscis short claviform or elongate cylindrical or bulbous distally in females; trunk fusiform or cylindrical; testes oval or spherical , 4 fusiform cement glands .... Family Cavisomatidae (39)

(39) a : Cavisomatidae parasitic in fresh-water fishes .... (40)

b : Cavisomatidae parasitic in marine fishes .... (42)

(40) a : Trunk cylindrical; structural dimorphism distinct in proboscis in females in which the proboscis is bulbous; neck truncated; in males proboscis is fusiform with largest hooks on the broader middle; 4 short compact cement glands widely separated from the testes; in Neotropical fishes .... Genus Megapriapus

b : Proboscis clavate or cylindrical; no dimorphism; cement glands discrete or compact .... (41)

(41) a : Proboscis claviform. trunk short, fusiform; cement glands compact; distant from testes; not contiguous; in Neotropical fishes .... Genus <u>Paracavisoma</u>

b : Proboscis cylindrical; cement glands 4 small discrete follicles; in Palaearctic fresh-water fishes .... Genus <u>Echinorhynchoides</u>

(42) a : Lemniscis digitiform, twice longer than proboscis receptacle; cement glands linguiform .... Genus <u>Pseudocavisoma</u>

b : Lemnisci shorter than or as long as proboscis receptacle, cement glands tubular or follicular ....(43)

(43) a : Trunk fusiform; lemnisci as long as the proboscis receptacle; cement glands in two parallel tubular pairs .... Genus <u>Rhadinorhynchoides</u>

b : Trunk elongate cylindrical; testes and cement glands in posterior 1/5 of trunk; lemnisci half as long as proboscis receptacle .... Genus <u>Cavisoma</u>

c : Trunk elongate fusiform; lemnisci longer than proboscis receptacle; testes pre-equatorial; proboscis short, slender cylindrical .... Genus <u>Neorhadinorhynchus</u>

(44) a : Trunk elongated, proboscis club-shaped; lemnisci modified into a ring-like ruff around the distal region of the

(44) a : proboscis receptacle; testes pre-equatorial; cement glands 6, tandem pyriform follicles widely separated from the testes and nearer posterior extremity .... Family Mirzasentidae
.... Genus *Mirzasentis*

b : Trunk long or short, cylindrical or fusiform; lemnisci tubular or digitiform; cement glands contiguous or adjacent to the posterior testis; proboscis elongated, cylindrical or claviform; may even be stumpy; with or without neck or pseudocollum; 6 pyriform of spheroidal cement gland follicles ...... Family Echinorhynchidae (45)

(45) a : Proboscis elongate slender, cylindrical, ellipsoidal or oval; hooks uniform; neck attenuated; trunk cylindrical; .... Subfamily Echinorhynchinae (46)

b : Trunk elongate fusiform; proboscis claviform or fusform; anterior hooks larger and slender, posterior few of each row abruptly smaller than the rest; neck distinct .... Subfamily Paracanthocephaloidinae (50)

(46) a : Fore-trunk broader thence tapering posteriorly; proboscis ventrally stooping; male reproductive organs in the posterior extremity .... Genus *Euzetacanthus*

b : Trunk long, cylindrical or fusiform; gonads and cement glands in the posterior half of the body; occassionally gonads pre-equatorial .... (47)

(47) a : Body short, fusiform; proboscis oval, with a few (5) oblique rows of hooks; apicals much longer than posteriors; cerebral ganglion basal .... Genus <u>Bolborhynchoides</u>

b : Trunk elongate, fusiform; proboscis ellipsoidal, with 25 longitudinal rows of hooks; cerebral ganglion in anterior region of the proboscis receptacle .... Genus <u>Metacanthocephaloides</u>

c : Trunk elongate, cylindrical; proboscis long, slender, cylindrical; pseudocollum present or wanting ......(48)

(48) a : Body short, fusiform; proboscis claviform with a long eversible pseudocollum .... Genus <u>Paracanthocephalus</u>

b : Trunk and proboscis long or short; cylindrical or fusiform; neck short, distinct or attenuated; no pseudocollum .... (49)

(49) a : Cerebral ganglion in the middle of the proboscis receptacle .... Genus <u>Echinorhynchus</u>

b : Cerebral ganglion at the base of the proboscis receptacle .... Genus <u>Acanthocephalus</u>

(50) a : Body elongate or short fusiform; proboscis oval or claviform; anterior hooks many times longer than the posterior few hooks of each row; usually 3 or 4 apicals, 3 or 4 basals .... Genus <u>Acanthocephaloides</u>

(53) a : Body elongated or fusiform; fore-trunk spinose; pre-soma with or without modifications; neck long or truncated; 4-6 cement glands .... (54)

b : Trunk elongated or fusiform, smooth, aspinose; neck distinct or attenuated, smooth or spinose; proboscis cylindrical, fusiform or club-shaped; lemnisci paired or multiple; 2-4 cement glands .... (59)

(54) a : with distinct sexual dimorphism; proboscis of females grossly inflated with radially disposed hooks; neck fairly long, slender .... Family Filicollidae .... Genus _Filicollis_

b : No sexual dimorphism; trunk elongated or fusiform; neck short, truncate conical or elongate, cylindrical; proboscis fusiform or oval to cylindrical; trunk spines in one or two fields .... Family Polymorphidae (55)

(55) a : Proboscis ellipsoidal; fore-trunk with two separate belts of spines; 4 cement glands .... Genus _Diplospinifer_

b : Trunk spines in a single field; neck long or short; 4-6 cement glands .... (56)

(56) a : Body fusiform with a narrow band of spines on fore-trunk, proboscis broader in the middle; 6 elongate slender cement glands .... Genus _Hexaglandula_

(56) b : Body elongate cylindrical or fusiform; trunk spines rather extensive; 2-4 elongate tubular cement glands .... (57)

(57) a : Trunk fusiform with anterior 1/3 beset with spines in circular rows; proboscis oval or spheroidal with quincunxial hook pattern; hooks gradually decreasing antero-posteriorly; lemnisci fusiform; 4 tubular cement glands .... Genus Polymorphus

b : Body long, cylindrical; proboscis elongate, sub-cylindrical or claviform, may be broad in the middle; spinose fore-trunk broader than the rest; 2-4 long slender cement glands; neck long or short; eggs with or without polar bulbs .... (58)

(58) a : Proboscis swollen towards the middle with larger hooks on the mid-dilatation; 13-36 longitudinal rows of hooks; spinose fore-trunk swollen distally; neck rather long; usually 2 cement glands; 4 in some species........... ....Genus Arhythmorhynchus

b : Trunk slender; proboscis claviform; no structural modifications in the pre-soma or fore-trunk; 4 cement glands; eggs with polar bulbs on the middle shell... .... Genus Skrjabinorhynchus

(59) a : Proboscis cylindrical or claviform; neck attenuated; proboscis receptacle inserted at the base of the proboscis which may be terminal or sub-terminal; 4-6

short or elongated cement glands; eggs with or without polar bulbs, lemnisci2-6.................................. .... Family Plagiorhynchidae (60)

b : Trunk long or fusiform; proboscis elongated or ovoid; hooks quincunxial; proboscis receptacle inserted in the mid-presomal region demarcating it into proboscis and neck which may be spinose or aspinose; lemnisci fusiform or tubular .... Family Centrorhynchidae (63)

(60) a : Proboscis claviform; distally broad and knob-like; neck narrower; hooks widely spaced; all alike; lemnisci fairly long, tubular; 4 elongated cement glands; in snakes of Far-East and Australian region .... Subfamily Sphaerechinorhynchinae .... Genus <u>Sphaerechinorhynchus</u>

b : Proboscis cylindrical or ellipsoidal; with numerous longitudinal rows of hooks; trunk elongate of fusiform; lemnisci 2 or more; parasitic in birds exclusively... .... Subfamily Plagiorhynchinae (61)

(61) a : Proboscis oval or ellipsoidal; trunk fusiform; lemnisci 4-6, ... Genus <u>Lueheia</u>

b : Proboscis cylindrical, oval or truncate conical; lemnisci 2; 3-4 cement glands .... (62)

(62) a : Proboscis cylindrical or sub-cylindrical, sub-terminal; short polar bulbs .... Genus <u>Plagiorhynchus</u>

(62) b : Proboscis oval; fore-trunk constricted; 4 discrete cement glands .... Genus Oligoterorhynchus

c : Proboscis truncate conical; neck absent; fore-trunk dilated; 3 cement glands .... Genus Pseudogordiorhynchus

(63) a : Body long or short, fusiform; proboscis hooks broad and stout; roots posteriad; neck with arcuate larger spines; roots anteriad; fore-trunk dilated; 2-4 tubular cement glands .... Subfamily Centrorhynchinae .... Genus Centrorhynchus.

b : Trunk long or short; cylindrical or fusiform; proboscis ovoid or ellipsoidal with stout hooks; neck distinct; smooth, aspinose ....Subfamily Porrorchinae (64)

(64) a : Trunk long. cylindrical, fore-trunk wider; anteriorly crateriform ; proboscis oval; neck smooth; lemnisci fusiform; 4 long tubular cement glands occupying about 2/3 body length; in Centropus species : Cuculidae of the Old World .... Genus Porrorchis

b : Trunk fairly long; proboscis sub-cylindrical; median hooks of each longitudinal row anchor shaped; 2 elongate cement glands .... Genus Owilfordia

c : Body short, fusiform; lemnisci fusiform or tubular; neck short, cylindrical or truncate conical ....(65)

(65) a : Body medium sized; trunk fusiform, broader in the anterior middle, more inflated dorsally; proboscis ovoid spherical; with relatively few (12) longitudinal rows of hooks; neck short, truncate conical; lemnissci short; fusiform, extending only a short distance beyond the proboscis receptacle; eggs with short bulbs. .... Genus Pseudolueheia

b : Body short, sigmoid in the male; anterior region of the trunk constricted in the males; proboscis broad cylindroid, with 24 longitudinal rows of hooks; neck culindroid; muscularised; lemnisci elongate, tubular; extending well upto the anterior testis; 4 long tubular cement glands entwined with each other. .... Genus Porrorchoides.

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(VII)

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PLATES I - XX.

Plate I.

Fig. 1 - 6 : Acanthogyrus thapari n. sp.

- 1 : Holotype male.
- 2 : Allotype female.
- 3 : Presoma of holotype male.
- 4 : Proboscis hooks.
- 5 : Trunk spines: (a) anterior, (b) posterior.
- 6 : Egg.

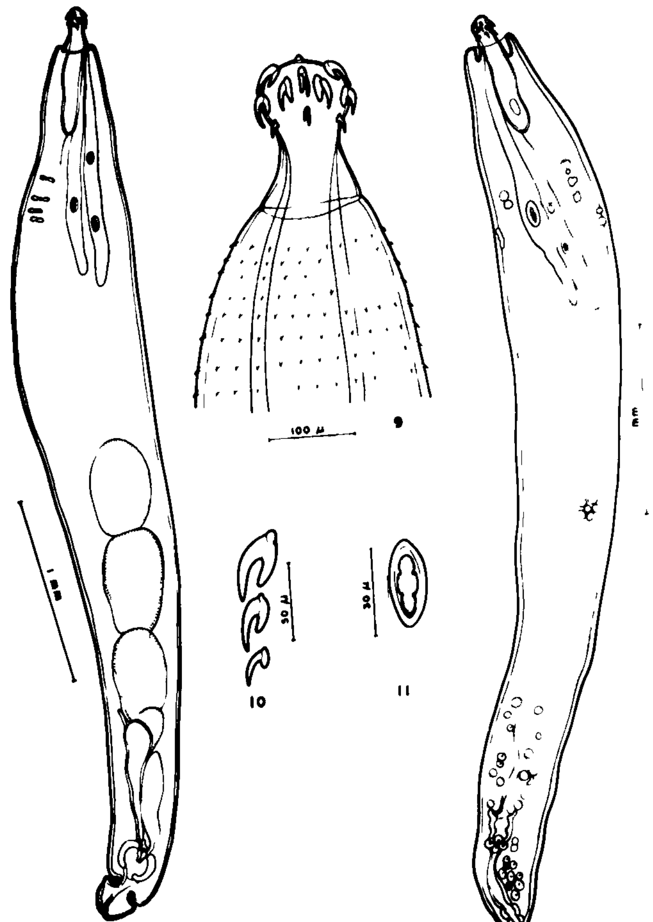
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Plate II.

Fig. 7 - 11 : Acanthosentis paucluncinatus n. sp.

- 7 : Holotype male.
- 8 : Allotype female.
- 9 : Proboscis of paratype male.
- 10 : Proboscis hooks.
- 11 : Egg.

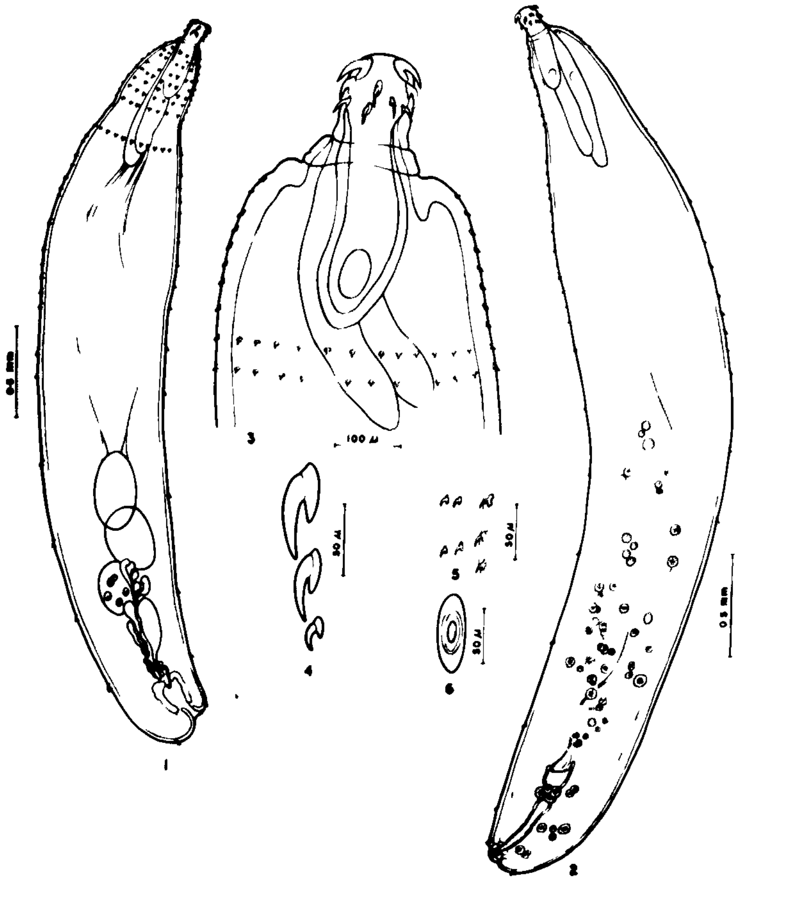
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Plate III.

Fig. 12 - 16 : *Pallisentis umbellatus* VAN CLEAVE, 1928.

- 12 : Paratype male (USNM Helm. Collection, No: 2067.3)
- 13 : Presoma and fore-trunk of paratype male (USNM Helm. Collection No: 2067.6)
- 14 : Posterior extremity of paratype female (USNM Helm. Collection No: 2074.2)
- 15 : Proboscis hooks of paratype male (x 450)
- 16 : Trunk spines : (a) of anterior girdle (b) of posterior rows.

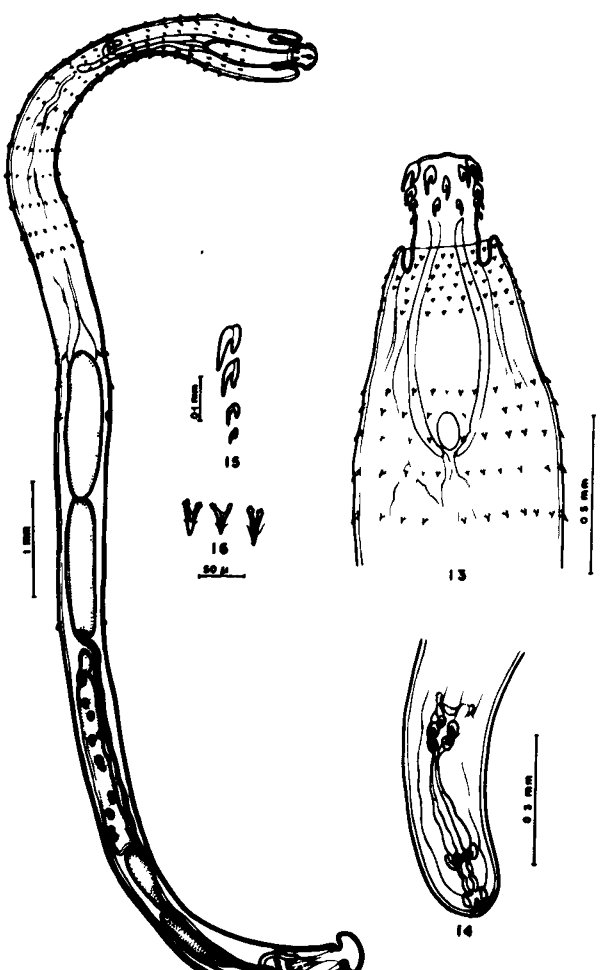
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Plate IV.

Fig. 17 - 24 : <u>Pallisentis fragilis</u> n. sp.

- 17 : Holotype male
- 18 : Allotype female
- 19 : Presoma of holotype male
- 20 : Hooks of apical circle
- 21 : Proboscis hooks
- 22 : Cuticular spines
- 23 : Posterior extremity of allotype female
- 24 : Egg.

Fig. 25 - 30 : <u>Pallisentis major</u> n. sp.

- 25 : Holotype male
- 26 : Allotype female
- 27 : Presoma of allotype female
- 28 : Proboscis hooks
- 29 : Cuticular spines
- 30 : Egg.

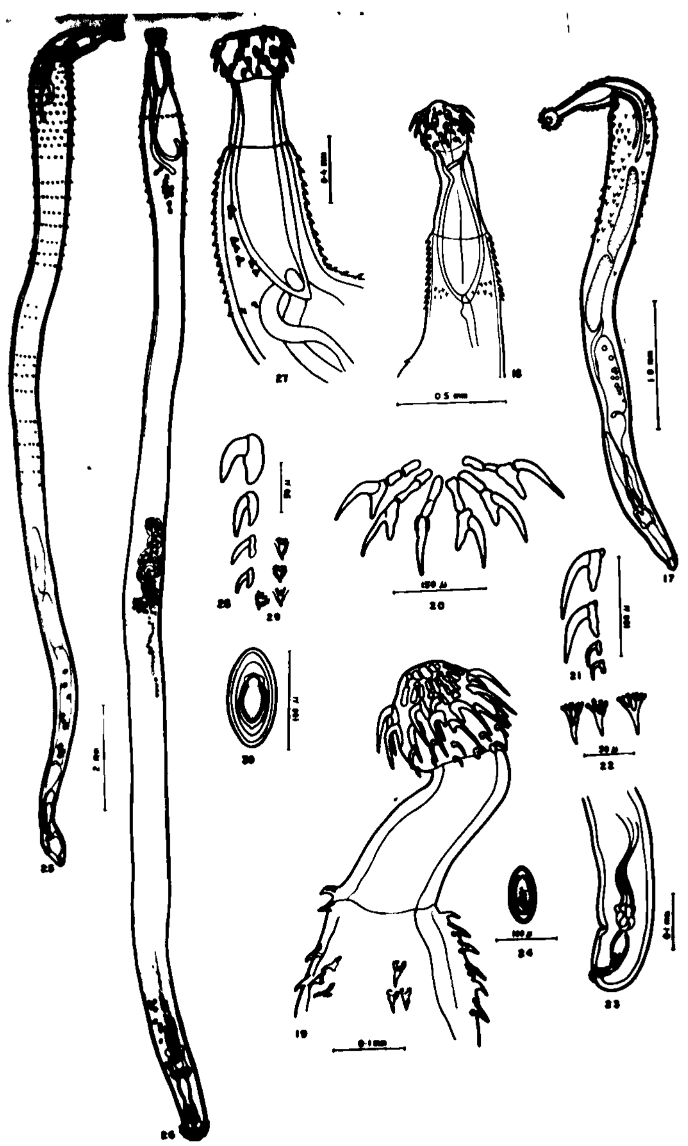


Plate V.

Fig. 31 - 37 : Quadrigyrus torquatus VAN CLEAVE, 1920.

- 31 : Topotype male ; Caracas Collection No. 1431.
- 32 : Posterior region of male : Caracas material.
- 33 : Anterior region of paratype female : USNM Helm. Collection No: 1227.10 (VAN CLEAVE'S type material).
- 34 : Posterior extremity of female : Caracas material.
- 35 : Paratype male, young, USNM Coll. No: 37671.
- 36 : Paratype female, young, USNM Coll. No: 3767.2.
- 37 : Giant hypodermic nucleus (dendritic) from posterior region of male.

Fig. 38 - 40 : Quadrigyrus brasiliensis MACHADO FILHO, 1941.

- 38 : Adult male : Caracas Collection.
- 39 : Adult (gravid) female ; Caracas Collection.
- 40 : Egg.

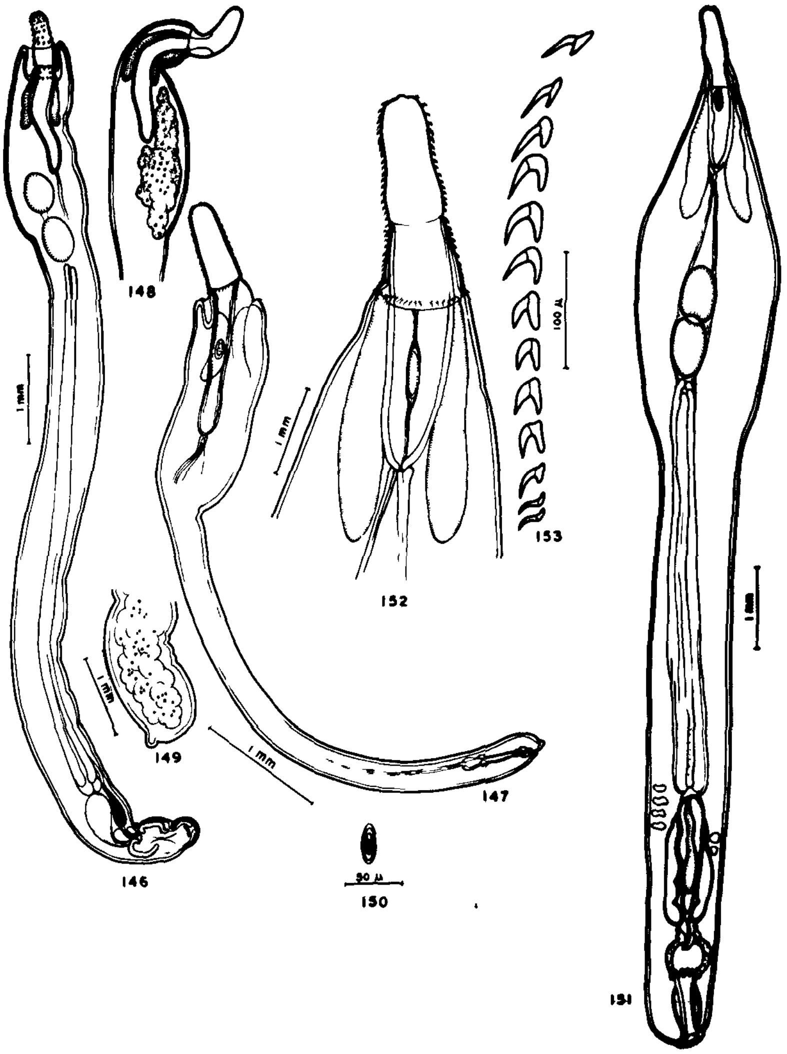

146
147
148
149
150
151
152
153
1 mm
1 mm
1 mm
1 mm
1 mm
100 µ
50 µ

Plate VI.

Fig. 41 - 45 : *Neoechinorhynchus acanthuri* n. sp.

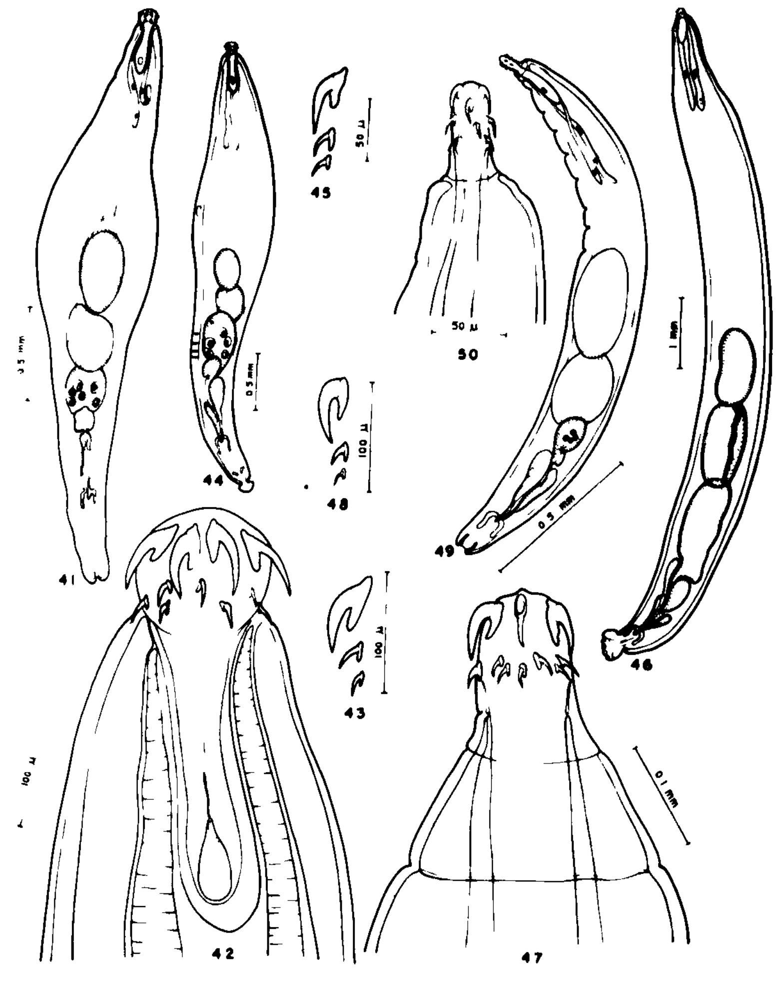
- 41 : Holotype male.
- 42 : Holotype male : anterior region.
- 43 : Proboscis hooks of holtype male.
- 44 : Cotype male.
- 45 : Cotype male : proboscis hooks.

Fig. 46 - 48 : *Neoechinorhynchus nigeriensis* n. sp.

- 46 : Holotype male.
- 47 : Holotype male : anterior region.
- 48 : Holotype male : proboscis hooks.

Fig. 49 - 50 : *Neoechinorhynchus minutus* n. sp.

- 49 : Holotype male : Caracas Collection.
- 50 : Holotype male : anterior extremity.



41
42
43
44
45
46
47
48
49
50
50 µ
100 µ
0.5 mm
1 mm
0.1 mm

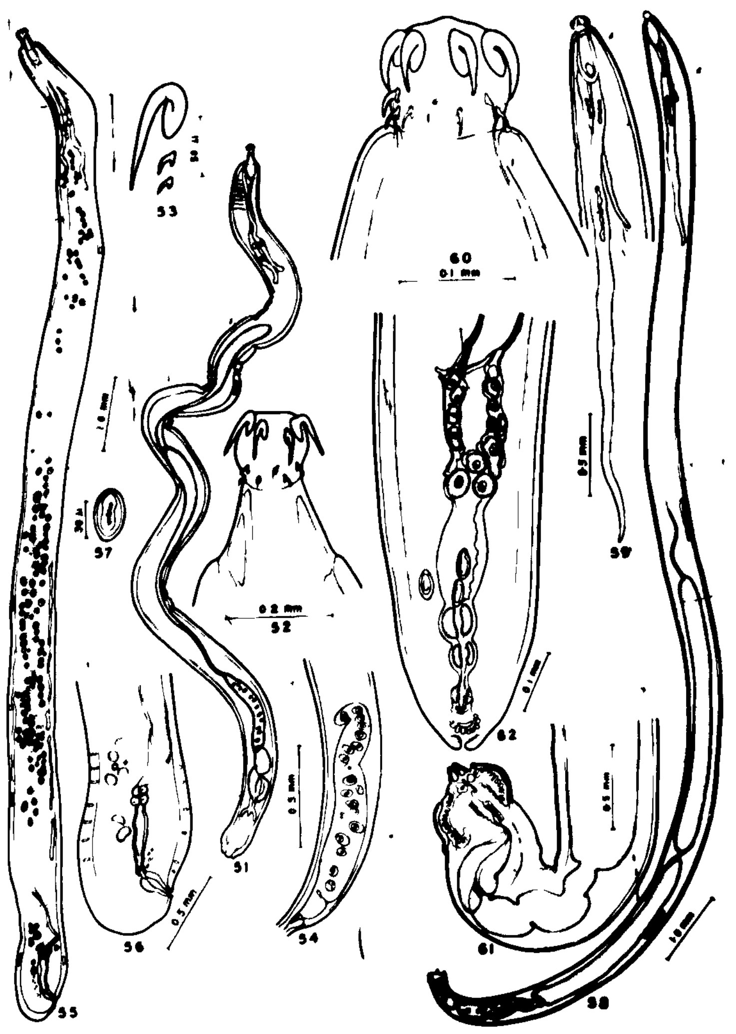
Plate VII.

Fig. 51 - 57 : <u>Neoechinorhynchus mollissimus</u> n. sp.

- 51 : Holotype male.
- 52 : Holotype male : anterior region.
- 53 : Holotype male : proboscis hooks.
- 54 : Paratype male : cement gland.
- 55 : Allotype female.
- 56 : Allotype female : posterior extremity.
- 57 : Egg.

Fig. 58 - 62 : <u>Neoechinorhynchus paratylosuri</u> n. sp.

- 58 : Holotype male.
- 59 : Holotype male : presoma and lemnisci.
- 60 : Proboscis of allotype female.
- 61 : Posterior extremity of cotype male : prolapsed bursa and the penis.
- 62 : Allotype female : posterior extremity.



51
52
0.2 mm
53
54
0.5 mm
55
56
0.5 mm
57
58
1.0 mm
59
0.5 mm
60
0.1 mm
61
0.5 mm
62
0.1 mm

Plate VIII.

Fig. 63 - 67 : *Floridosentis longinuchalis* n. sp.

- 63 : Holotype male.

- 64 : Holotype male : presoma.

- 65 : Allotype female : proboscis.

- 66 : Allotype female : posterior extremity.

- 67 : Egg.

Fig. 68 - 69 : *Tanaorhamphus ambiguus* VAN CLEAVE, 1921.

- 68 : Male : Durham material.

- 69 : Female : Durham material.

(Durham, N.H., material : courtesy W.L.Bullock)

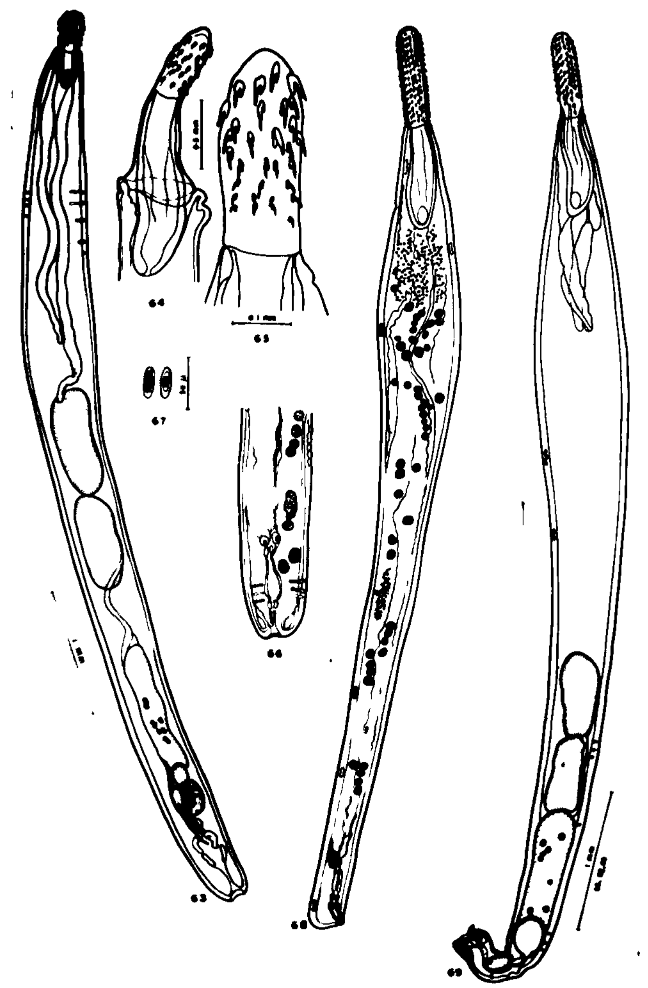

63
64
65
66
67
68
69

Plate IX.

Fig. 70 - 73 : Acanthodelta scorzai DIAZ-UNGRIA et RODRIGO, 1958

- 70 : Holotype male (Courtesy Caracas Museum).
- 71 : Holotype male : presoma & fore-trunk.
- 72 : Holotype male : proboscis hooks.
- 73 : Holotype male : 'tusks'.

Fig. 74 - 82 : Nipporhynchus atheri n. sp.

- 74 : Holotype male.
- 75 : Holotype male : anterior extremity.
- 76 : Proboscis hooks : lateral linear profiles.
- 77 : 'Corona radiata' of basal circle.
- 78 : Posterior extremity of paratype male.
- 79 : Allotype female.
- 80 : Trunk spines of female.
- 81 : Posterior extremity of paratype female.
- 82 : Egg.

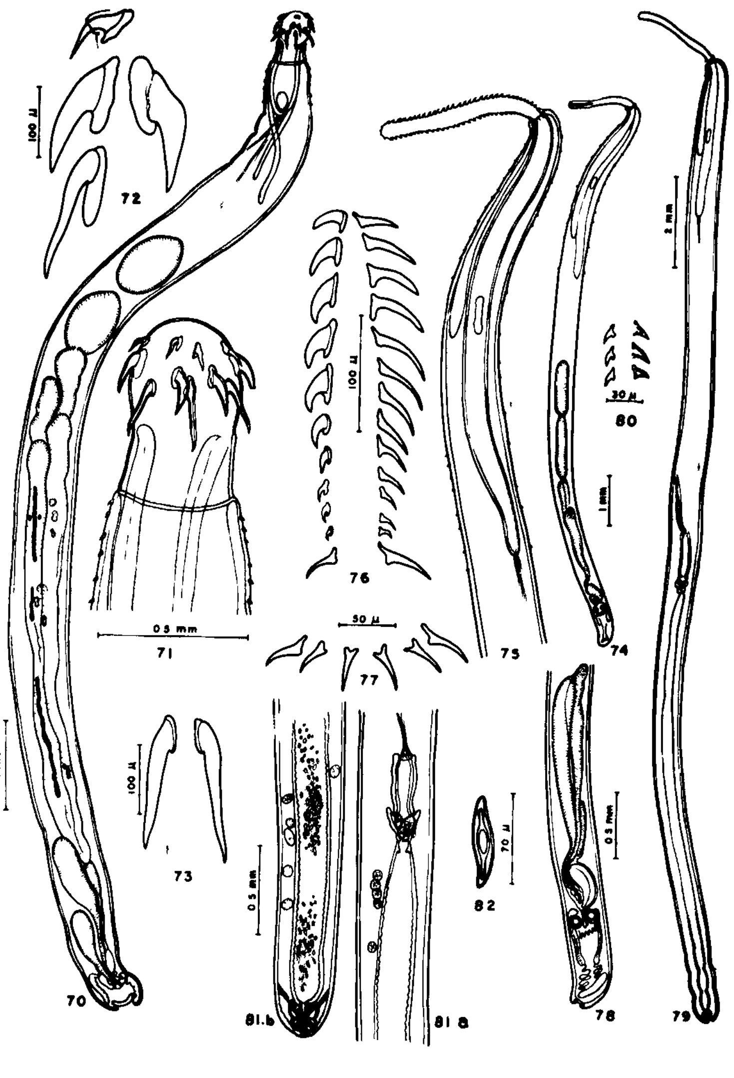

100 µ
72
0.5 mm
71
100 µ
76
50 µ
77
2 mm
30 µ
80
1 mm
75
74
1 mm
100 µ
73
0.5 mm
70 µ
82
0.5 mm
70
81.b
81 a
78
79

Table X.

Fig. 83 - 88 : Micracanthorhynchina indica n. sp.

- 83 : Holotype male.
- 84 : Proboscis hooks.
- 85 : Allotype female.
- 86 : Allotype female : posterior extremity.
- 87 : Egg.
- 88 : Trunk spine.

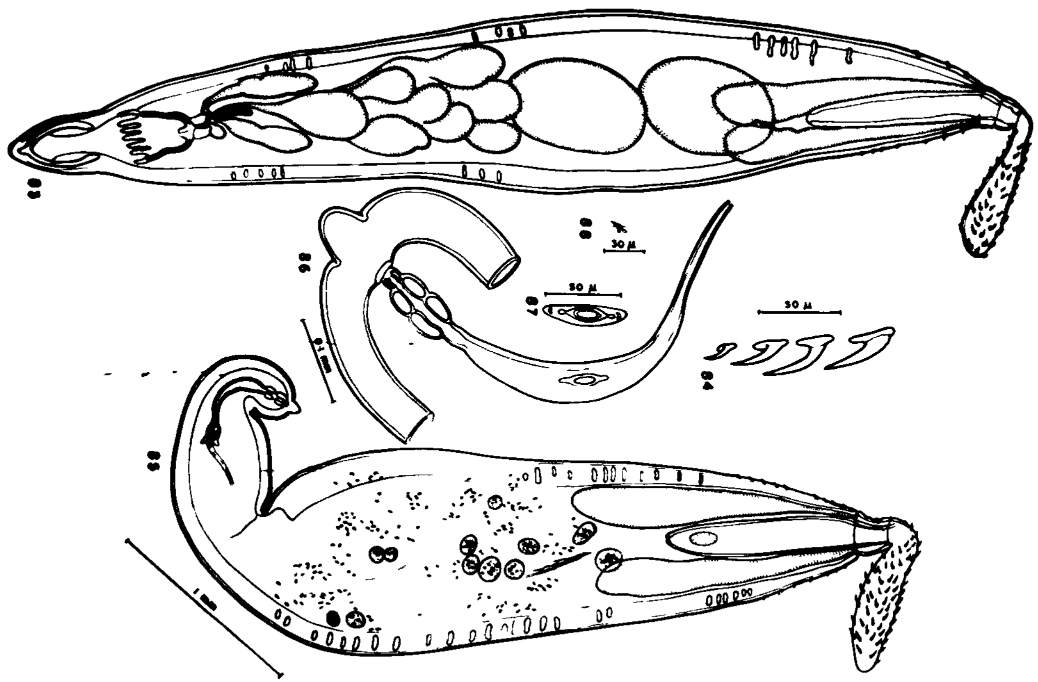
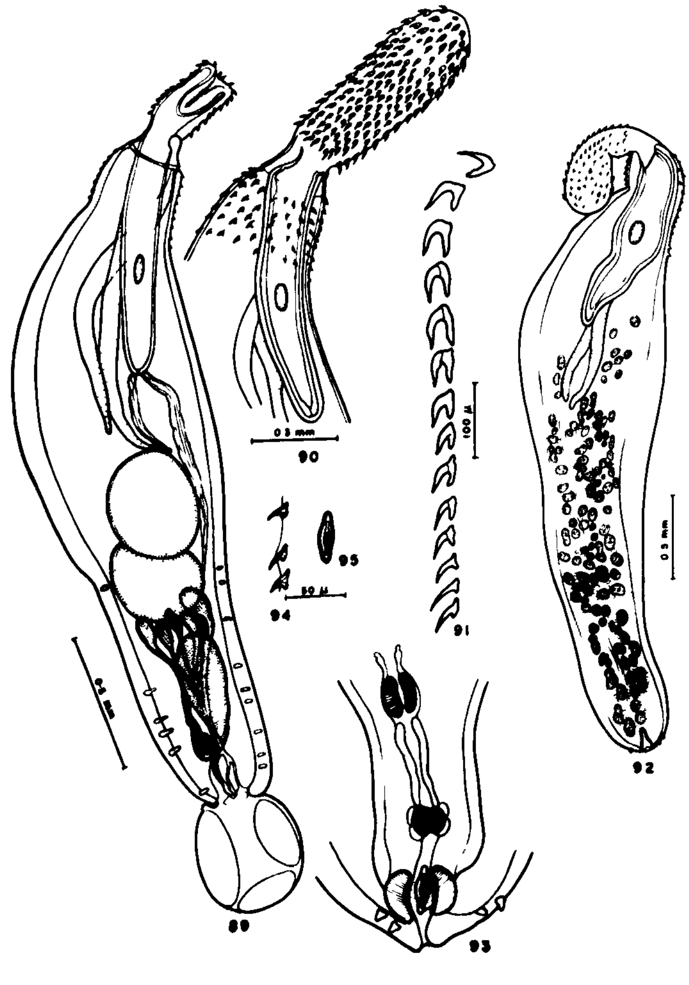

83
84
85
86
87
88
50 µ
30 µ
50 µ
0·1 mm
1 mm

Plate XI.

Fig. 89 - 95 : *Mehrarhynchus alami* n. sp.

- 89 : Holotype male.
- 90 : Holotype male : presoma.
- 91 : Proboscis hooks; lateral linear profile.
- 92 : Allotype female.
- 93 : Allotype female : posterior extremity.
- 94 : Trunk spine.
- 95 : Egg.

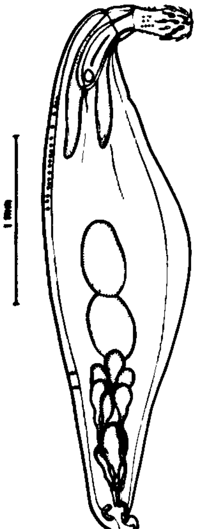


89
90
0.3 mm
91
100 µ
92
0.3 mm
93
94
95
50 µ

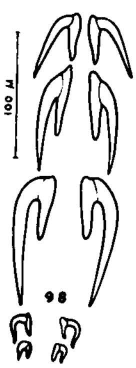
Plate XII.

Fig. 96 - 99 : <u>Acanthocephaloides venustus</u> n. sp.

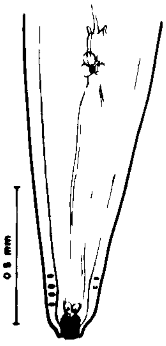
- 96 : Holotype male.
- 97 : Proboscis of holotype male.
- 98 : Proboscis hooks.
- 99 : Posterior extremity of female.



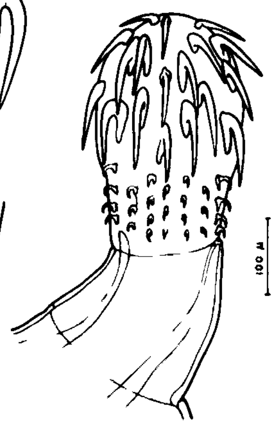
96



98



99

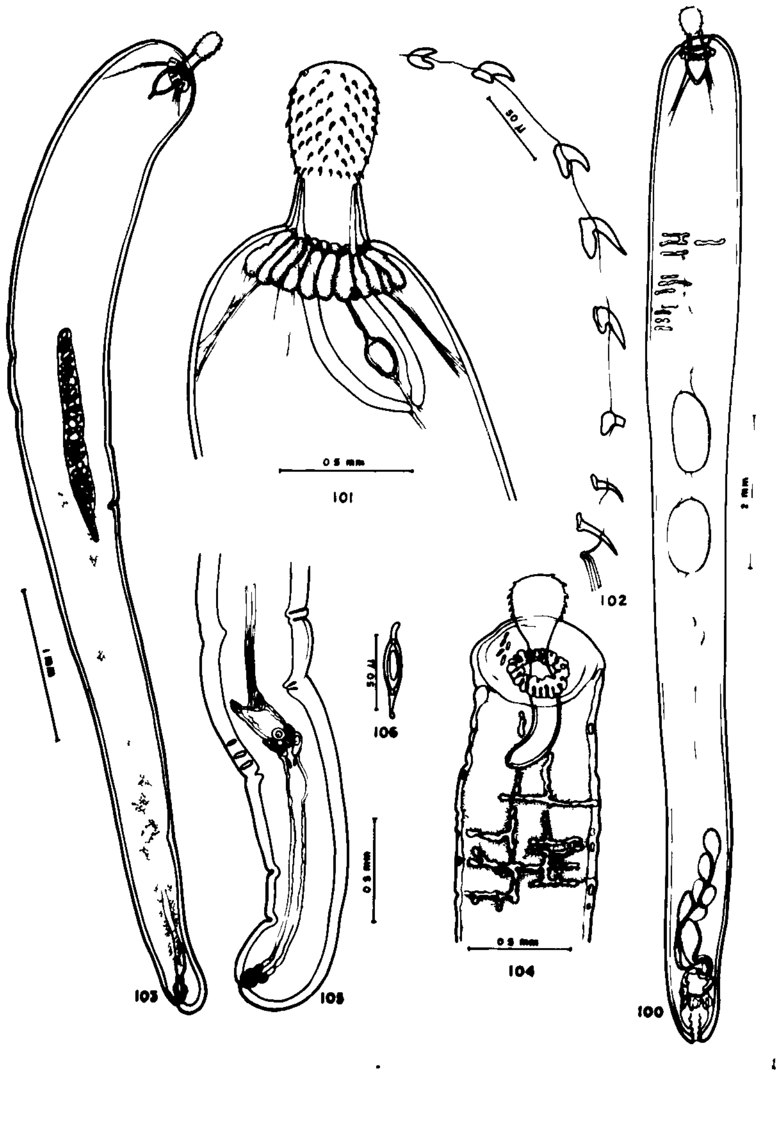


97

Plate XIII.

Fig. 100 - 106 : _Mirzasentis torquis_ n.g., n.sp.

- 100 : Holotype male.
- 101 : Holotype male : presoma.
- 102 : Proboscis hooks : lateral file.
- 103 : Allotype female.
- 104 : Allotype female : lemniscular collar and lacunar canals.
- 105 : Paratype female : posterior extremity.
- 106 : Egg.



50 µ
0.5 mm
101
102
2 mm
1 mm
50 µ
106
0.5 mm
0.5 mm
104
103
105
100

Plate XIV.

Fig. 107 - 114 : Longicollum pulcher n. sp.

- 107 : Holotype male.
- 108 : Holotype male : proboscis.
- 109 : Holotype male : proboscis hooks in linear file
- 110 : Allotype female.
- 111 : Paratype female, immature, with skeletal muscle bands in the fore-trunk.
- 112 : Paratype female : posterior extremity.
- 113 : Gravid ovary of paratype female.
- 114 : Egg.

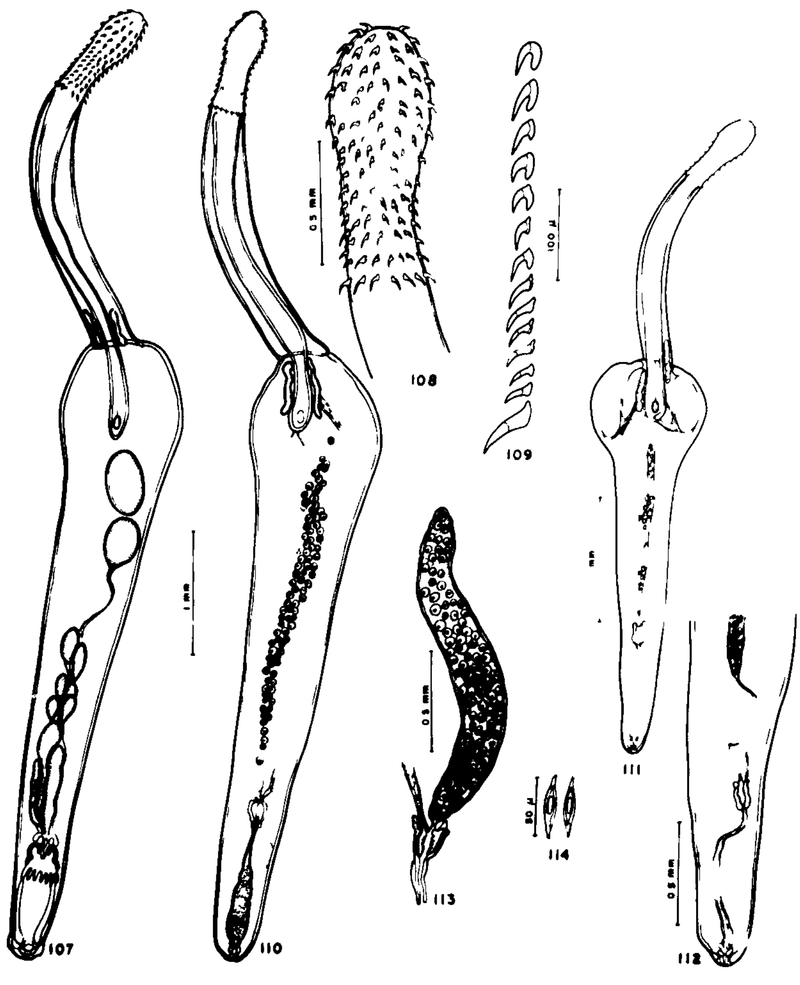

107
108
109
110
111
112
113
114
1 mm
0.5 mm
100 μ
50 μ

Plate XV.

Fig. 115 - 119 : Parafilisoma diazungriai n. g., n. sp.

- 115 : Holotype male : Caracas Collection.
- 116 : Paratype male, young.
- 117 : Allotype female : presoma.
- 118 : Allotype female : proboscis hooks.
- 119 : Posterior extremity of allotype female showing the terminal conical region and preceding pseudosegments.

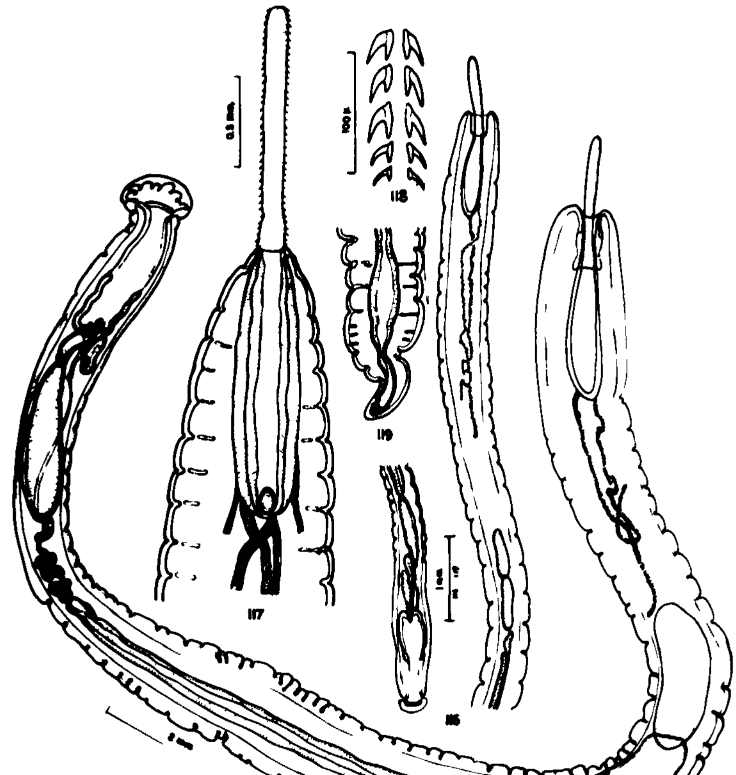

117
118
119
116
115

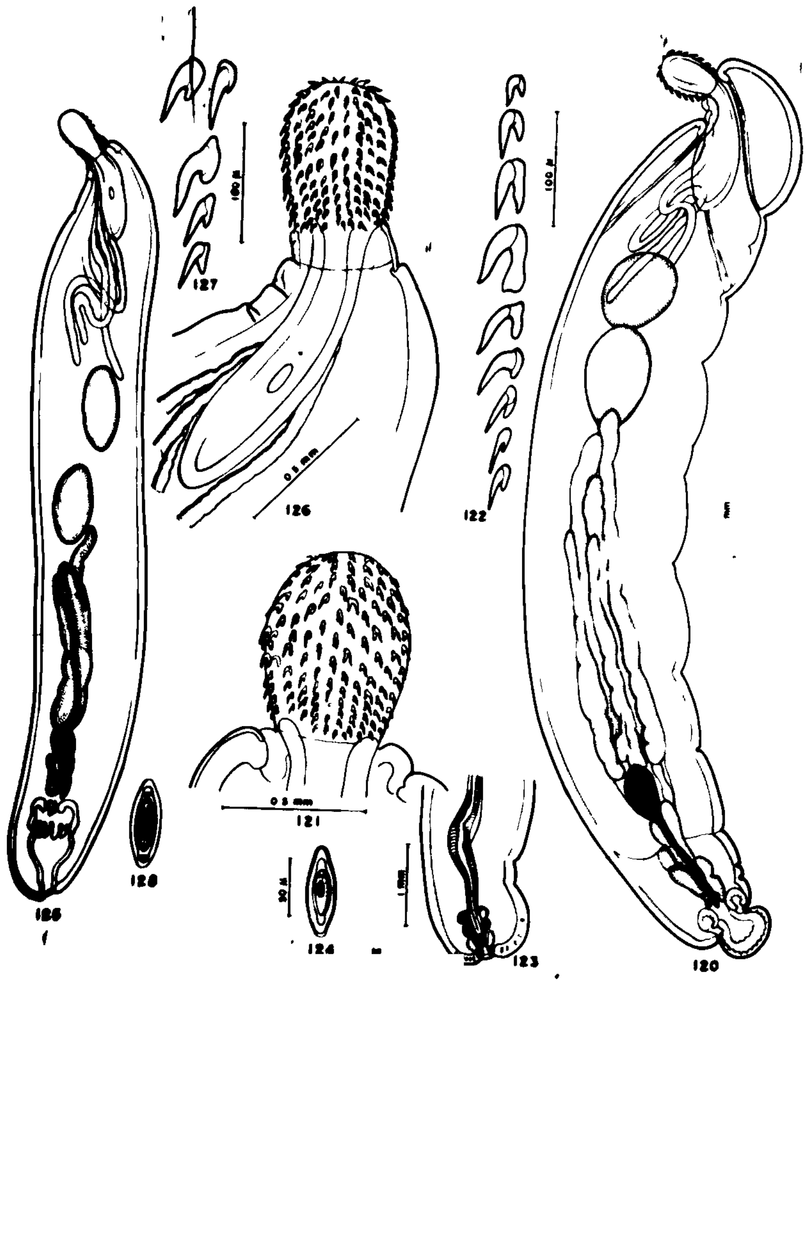
Plate XVI.

Fig. 120 - 128 : *Plagiorhynchus salubris* n. sp.

- 120 : Holotype male.
- 121 : Allotype female : presoma.
- 122 : Proboscis hooks : different types.
- 123 : Allotype female : posterior region.
- 124 : Egg.

Fig. 125 - 128 : *Lueheia mitis* n. sp.

- 125 : Holotype male.
- 126 : Allotype female : presoma.
- 127 : Proboscis hooks.
- 128 : Egg.



127
126
122
121
0.5 mm
125
128
124
123
120

Plate XVII.

Fig. 129 - 131 : <u>Plagiorhynchus reticulatus</u> TRAVASSOS.

- 129 : Male : Caracas material.
- 130 : Proboscis hooks : (a) & (b) : lateral linear files.
- 131 : Egg.

Fig. 132 - 136 : <u>Porrorchoides texeres</u> n. gen., n. sp.

- 132 : Holotype male.
- 133 : Allotype female.
- 134 : Presoma of allotype female.
- 135 : Proboscis hooks : linear profile.
- 136 : Egg.

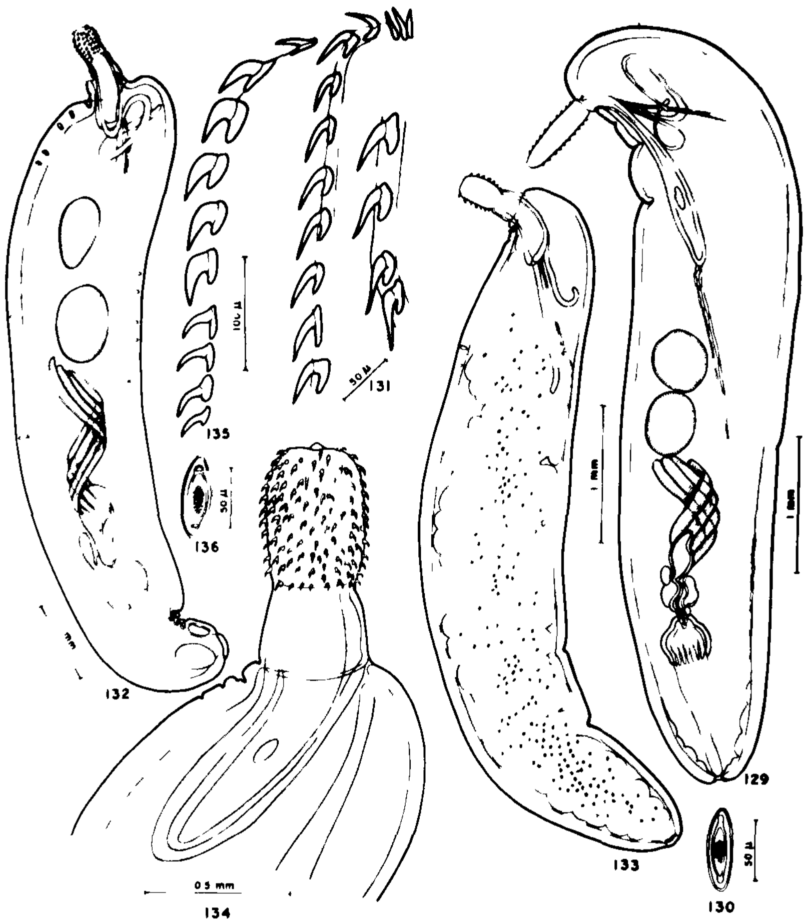

100 µ
50 µ
131
135
30 µ
136
1 mm
132
0.5 mm
134
1 mm
133
1 mm
129
50 µ
130

Plate XVIII.

Fig. 137 - 140 : <u>Centrorhynchus lepidus</u> n. sp.

- 137 : Holotype male.
- 138 : Allotype female: anterior region.
- 139 : Allotype female : posterior extremity.
- 140 : Proboscis hooks : linear profile.

Fig. 141 - 143 : <u>Centrorhynchus clunis</u> n. sp.

- 141 : Holotype male.
- 142 : Holotype male : presoma & fore-trunk.
- 143 : Proboscis hooks.

Fig. 144 - 145 : <u>Centrorhynchus venezuelensis</u> n. sp.

- 144 : Holotype male : presoma & fore-trunk.
- 145 : Proboscis hooks.

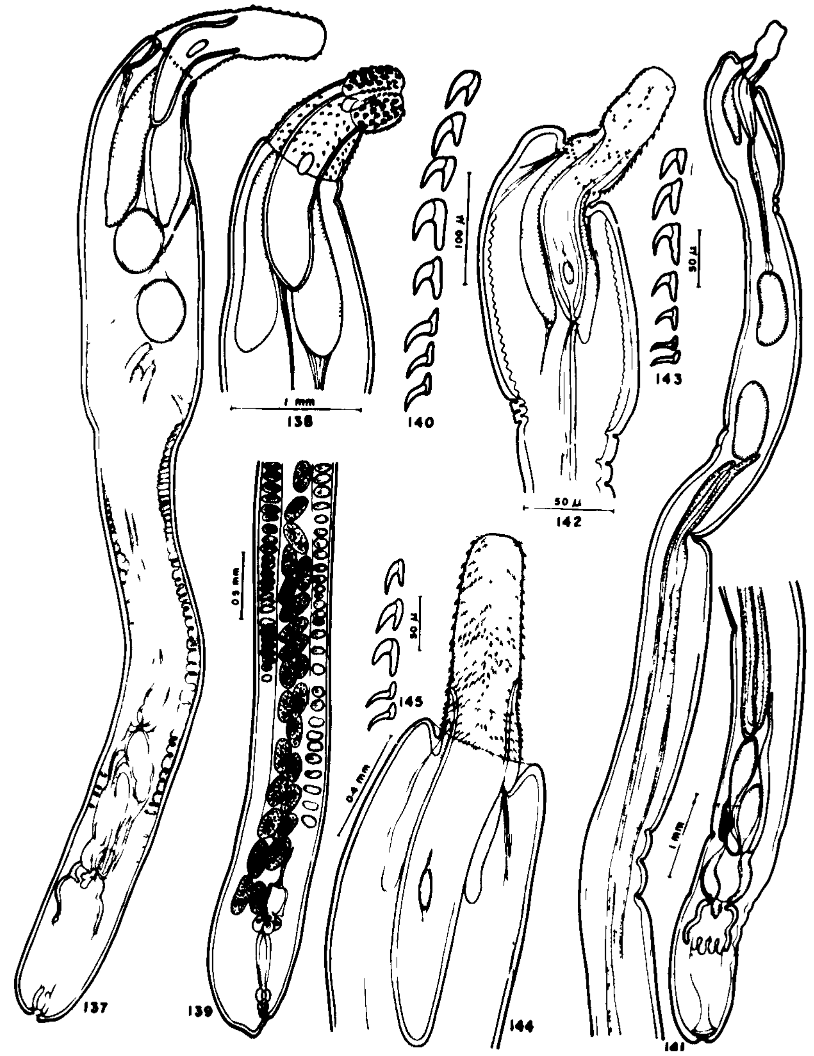

137
1 mm
138
100 µ
140
50 µ
142
50 µ
143
0.5 mm
139
50 µ
145
0.4 mm
144
1 mm
141

Plate XIX.

Fig. 146 - 150 : <u>Centrorhynchus venezuelensis</u> n. sp.

- 146 : Holotype male.
- 147 : Allotype female.
- 148 : Allotype female : *presoma & fore-trunk.*
- 149 : Allotype female : posterior extremity.
- 150 : Egg.

Fig. 151 - 153 : <u>Centrorhynchus pseudibicola</u> n. sp.

- 151 : Holotype male.
- 152 : Holotype male : presoma.
- 153 : Holotype male : proboscis hooks, lateral linear profiles.

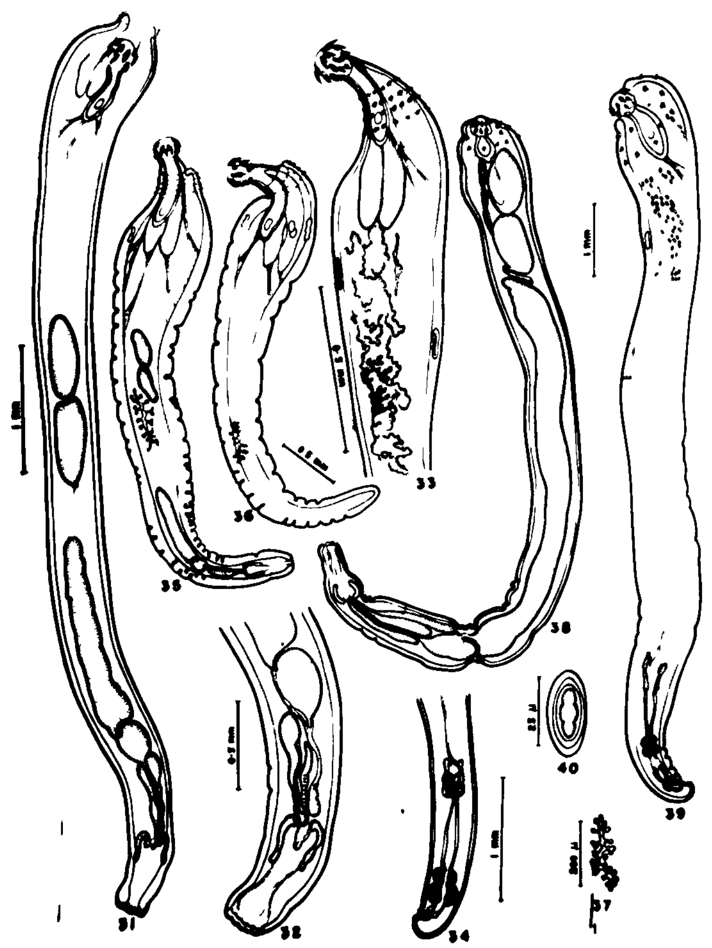
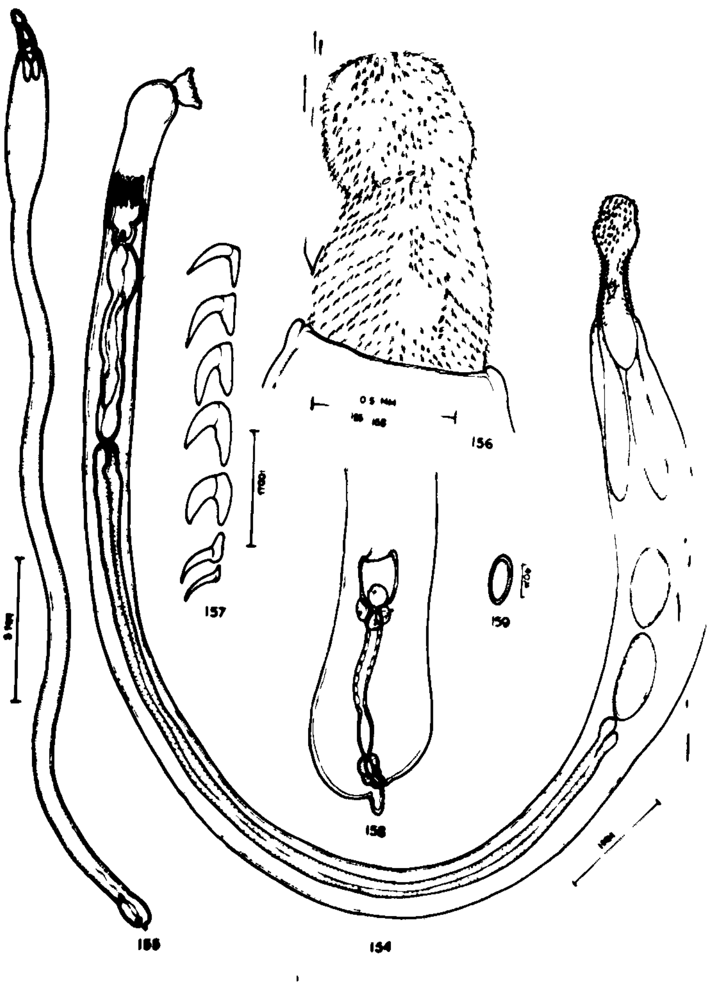

31
32
33
34
35
36
37
38
39
40
1 mm
0·5 mm
25 µ
200 µ

Plate XX.

Fig. 154 - 159 : *Centrorhynchus ophionis* n. sp.

- 154 : Holotype male.
- 155 : Allotype female.
- 156 : Allotype female : proboscis.
- 157 : Proboscis hooks.
- 158 : Allotype female : posterior extremity.
- 159 : Egg.



155
154
156
157
158
159
0.5 MM